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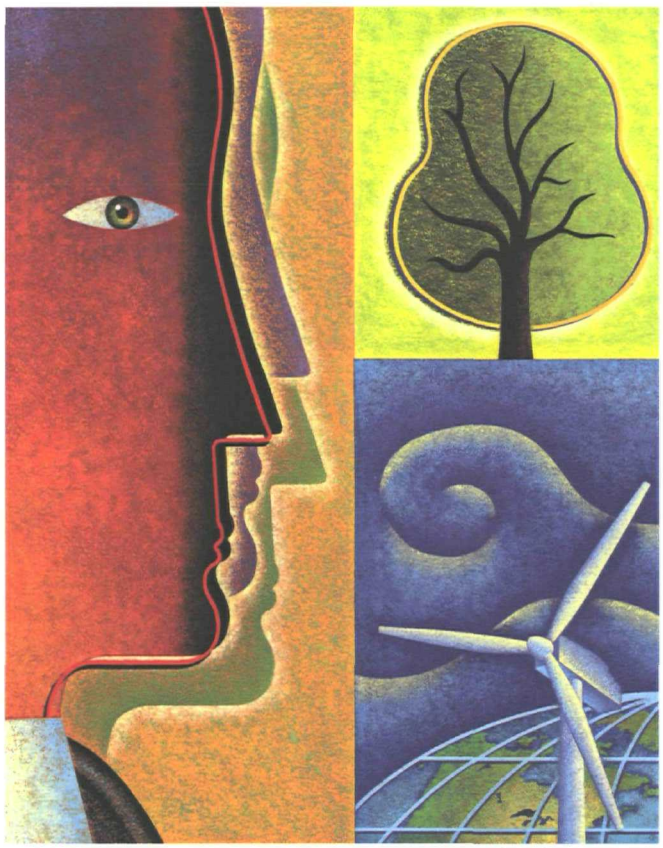
Documentation of the Predesign Studies

12th Street Landfill
Otsego Township, Michigan

August 2008



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Documentation of the Predesign Studies

12th Street Landfill Otsego Township, Michigan

Operable Unit No. 4 of the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

August 2008

Prepared by RMT, Inc.
on behalf of Weyerhaeuser Company

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Section 1
Introduction

1.1 Background

In December 2004, Weyerhaeuser Company (Weyerhaeuser) entered into a Consent Decree (CD) with the United States Environmental Protection Agency (U.S. EPA) for work to be conducted at the 12th Street Landfill (landfill) and the former Plainwell Mill (mill) sites. The Statement of Work (SOW) for the Remedial Design/Remedial Action (RD/RA) for the 12th Street Landfill operable unit (OU-4) requires excavating wastewater residuals outside the footprint of the landfill, relocating the excavated material back into the landfill, constructing a final cover over the landfill, installing erosion protection measures, and implementing various monitoring activities.

In June 2008, the U.S. EPA approved the Remedial Design Workplan (RD Workplan) for the 12th Street Landfill (RMT, 2008), which outlined the predesign studies needed to assist in the development of the remedial design for OU-4. The predesign studies included a field investigation, which consisted of installing a series of test pits and soil borings at strategic locations; collecting landfill gas monitoring data from soil borings and select groundwater monitoring wells; and measuring groundwater and surface water elevations at existing groundwater wells, piezometers, and staff gauges that encircle the landfill. The desktop evaluations included determining the potential need for a leachate collection system and reviewing available information concerning the management of landfill gas at other operable units of the Kalamazoo River Superfund Site for potential applicability to the design of a passive landfill gas venting system at the 12th Street Landfill.

1.2 Purpose and Scope

The purpose and scope of this report are to document the findings of the predesign field investigation and desktop evaluations conducted pursuant to the approved RD Workplan for the 12th Street Landfill and to present Weyerhaeuser's conclusions and recommendations drawn from this information. The additional information obtained from the predesign studies will be used in the development of the remedial design for the 12th Street Landfill operable unit.

Section 2
Predesign Studies Implementation

2.1 Field Preparation

Prior to beginning the predesign field investigation, permission to access the State property and the asphalt plant property was obtained from the Michigan Department of Natural Resources and Aggregate Industries, respectively. Holland Engineering, Inc. (Holland), of Holland, Michigan, marked the site property lines and the proposed test pit and soil boring locations that were presented in the approved RD Workplan. Underground utilities were identified and marked. Trees were cleared, as needed, by Integrity Tree Services, of Allendale, Michigan, on the State property and on the northeastern landfill slope to gain access to the proposed test pit locations.

The U.S. EPA's field oversight contractor, CH_2M Hill, provided oversight during most of the predesign fieldwork. Modifications from the predesign field investigation, which was presented in the approved RD Workplan, were discussed either with the U.S. EPA's field oversight contractor, or directly with the U.S. EPA project manager. Verbal approval was obtained from either the U.S. EPA's field oversight contractor or the U.S. EPA project manager prior to implementing the modification. (The field oversight contractor made the decision as to which field modifications required consultation with the U.S. EPA project manager.)

2.2 Delineation of Visible Residuals Outside the Landfill Footprint

Prior to Weyerhaeuser's investigation, the areal limits of visible paper residuals outside the footprint of the landfill were delineated based on information obtained by Geraghty and Miller and the U.S. EPA in 1994 and 2003, respectively (G&M, 1994b and U.S. EPA, 2004). This information was summarized in Subsection 4.4 of the RD Workplan and was illustrated on Figure 8 of that document. The objective of this predesign investigation was to update the limits of visible paper residuals outside the footprint of the landfill to more accurately estimate the quantity of material that needs to be excavated and relocated into the landfill prior to final closure. This information is also needed to support discussions with the owners of the adjacent properties concerning the implementation of the remedial action. Based on the findings of this predesign investigation, the limits of visible paper residuals have been updated as shown on Figure 1.

As shown on Figure 1, eleven test pits (RDTP-01 through -11) were excavated with a backhoe by Mateco Drilling Company (Mateco), from Grand Rapids, Michigan, on June 9, 11, 12, and 27, 2008. RMT, Inc. (RMT), provided oversight of the test pit excavations. Field notes are included in Appendix A. The as-constructed locations and dimensions of the test pits were slightly adjusted in the field from the proposed locations presented in the approved RD Workplan due to site conditions (e.g., the proximity of a test pit to readily identifiable paper residuals on the ground surface and/or to trees). Each test pit was logged by the

on-site geologist/engineer, and the logs are contained in Appendix A. Following completion of each test pit, clumps of soil and loose material were removed from the bucket of the backhoe, as needed, prior to moving to the next test pit location. Material excavated from each test pit was placed back into the excavation and compacted sufficiently with the backhoe bucket to minimize erosion from surface water runoff. The limits of visible paper residuals were marked in the field and subsequently surveyed for horizontal and vertical location by Holland.

A summary of the observations made at each location is provided in Table 1.

Summary of Delineation of Visible Residuals Outside the Landfill Footprint

The objectives for collecting additional data to confirm the delineation of visible paper residuals outside the landfill footprint, as described in the RD Workplan, were met. Sufficient information has been obtained to prepare the remedial design for the landfill. The field observations also confirmed that visual identification of paper residuals is an appropriate criteria for delineating areas to be excavated as part of the remedial action construction. Figure 1 shows the revised areal extent of visible paper residuals outside the footprint of the landfill, incorporating the information obtained from the predesign studies.

Based on the areal limits and thicknesses of visible paper residuals present in areas beyond the footprint of the landfill, RMT has estimated that approximately 12,200 cubic yards (cy) of visible paper residuals may need to be excavated and relocated back into the landfill (4,500 cy from the wetland, 200 cy from the State property, and 7,500 cy from the asphalt plant property).

2.3 Data for Grading Design

As discussed in the RD Workplan (RMT, 2008), additional data regarding the thickness of paper residuals in the landfill along the property boundaries with 12th Street, with the asphalt plant to the southwest, and with the State property to the southeast were needed to reduce uncertainties in designing the final cover grades. This information is also needed to support discussions with the owners of these adjacent properties concerning the implementation of the remedial action. The data were obtained by advancing Geoprobe® borings into the landfill at 11 locations (RDB-01 through -11). In addition to the advancement of a Geoprobe® boring at RDB-10, a test pit (RDTP-12) was excavated at this location because the sample recovery was poor due to the presence of sandy subsurface material at this location. Based on the practical use of down-hole equipment, and to increase productivity, two separate Geoprobe® borings that were spaced approximately 1 foot apart were advanced at each location – one for visually classifying the materials encountered and the other for measuring landfill gas compositions.

The soil borings used for visually classifying the materials encountered were advanced 14 to 35 feet below ground surface (bgs) into the 12th Street Landfill, sampled continuously, and logged by the on-site geologist/engineer. A representative sample of each type of material encountered was collected for quality control (QC) review by a geotechnical engineer in the office (no laboratory analyses were

performed). Soil boring logs for each borehole are contained in Appendix A. Following the completion of the drilling activities, the borings were abandoned by filling them with bentonite, and the locations were surveyed for horizontal and vertical coordinates by Holland. The as-constructed locations of the Geoprobe® borings (and test pit RDTP-12) are shown on Figure 1. The locations were slightly adjusted in the field from the proposed locations due to site conditions (e.g., locations of the soil borings relative to the top of the landfill slope and to trees/vegetation).

A summary of the findings from the Geoprobe® borings and test pit that will be used in the grading design follows:

- Existing materials over the paper residuals are 0 to 18.5 feet thick and generally consist of layers of 0.5 to 1.0 foot of topsoil, on top of 0.2 to 1.0 foot of granular fill, and 0.5 to 9.5 feet of fly ash, with the remaining portion being a granular fill. Fly ash was present in eight of the 11 soil borings.
- Visible paper residuals were encountered in nine of the 11 soil borings and were present at thicknesses ranging from 0.2 to 17 feet. Paper residuals were present on the ground surface at RDB-06. Paper residuals were not found in RDB-01 or -10.
- Construction debris (bricks) was found 0.5 foot below ground surface (bgs) at the test pit excavated at RDB-10 (test pit RDTP-12). Paper residuals were also found on the northern end of this test pit.
- Petroleum odors were noted in the paper residuals, and in the native sand and gravel at Geoprobe® borings RDB-04, -07, -08, and -09. The source of the petroleum odors was not identified.
- Landfill gas odors were noted in the paper residuals and the native sand at Geoprobe® borings RDB-02 and -03.

Summary of Data Collected for Grading Design

The objectives described in the RD Workplan for collecting additional data to better estimate the thickness of paper residuals along the property boundaries with 12th Street, with the asphalt plant to the southwest, and with the State property to the southeast, in order to reduce uncertainties in designing the final cover grades and to support discussions with the owners of these adjacent properties concerning access for purposes of implementing the remedial action, were met. In general, the bottom of the landfill along the property boundaries between the asphalt plant and between the State property is deeper than anticipated, and the upward slope of the bottom of the landfill toward 12th Street is also steeper than anticipated. Sufficient information has been obtained to prepare the remedial design for the landfill.

2.4 Landfill Gas Evaluation

As described in the RD Workplan, based on experience at other landfills containing paper residuals, Weyerhaeuser plans to install a passive gas venting system to prevent potential off-site gas migration from the landfill and to protect the integrity of the final cover. The detailed design of the passive gas venting system will be prepared during the design phase for the 12th Street Landfill and may include features that support the potential future development of the site as an "eco-park." The passive gas

venting system will also be designed such that it could be retrofitted to an active gas system if deemed necessary during the operations, monitoring, and maintenance (OM&M) period for the landfill.

To assist in the design of the passive gas venting system, concentrations of methane, carbon dioxide, and oxygen were measured in the existing groundwater monitoring wells that are screened in the vadose zone (MW-6A, MW-7A, and MW-8A), and in the Geoprobe® boreholes advanced into the 12th Street Landfill (RDB-01 through -11). Information provided by the MDEQ in connection with the management of subsurface landfill gas at the King Highway Landfill (Operable Unit #3) was also reviewed for potential applicability to the 12th Street Landfill.

The existing groundwater monitoring wells in which a portion of the well screen was above the water table (MW-6A, MW-7A, and MW-8A) were retrofitted with sample ports on June 9, 2008. Gas composition and pressures were measured in the wells on June 11, 2008. Landfill gas monitoring data from the existing groundwater monitoring wells are summarized in Table 2.

As described in Subsection 2.3 of this report, Geoprobe® borings were advanced into the 12th Street Landfill at 11 locations (RDB-01 through -11) on June 9-11, 2008, by Mateco. Based on the practical use of down-hole equipment, and to increase productivity, two separate Geoprobe® borings that were spaced approximately 1 foot apart were advanced at each location – one for visually classifying the materials encountered and the other for measuring landfill gas compositions.

Landfill gas compositions were measured at the approximate depth at which there was believed to be the greatest potential for the presence of landfill gas (i.e., at the approximate depth at which paper residuals were present above the water table). This depth ranged from 10 to 25 feet bgs. Landfill gas monitoring data from the Geoprobe® borings are summarized in Table 2. If paper residuals were not present in a soil boring, the gas compositions were measured approximately 10 to 15 feet bgs. Following the landfill gas monitoring activities, the borings were abandoned by filling them with bentonite. The following is a summary of the findings from these measurements and associated field observations:

- Methane was detected in one of the three groundwater monitoring wells (MW-6A) at a concentration of 0.2 percent by volume, which is an order-of-magnitude less than the Lower Explosive Limit for methane of 5 percent by volume.
- Positive pressure was not detected in any of the groundwater monitoring wells.
- Methane was detected in five of the 11 Geoprobe® borings (RDB-03, -04, 07, -08, and -09) at concentrations that ranged from 0.9 to 24.7 percent by volume.
- No areas of stressed cover vegetation were noted, nor were landfill gas odors observed while walking over the cover.
- Landfill gas odors were noted in the paper residuals and in the native sand at Geoprobe® borings RDB-02 and RDB-03.

In response to a Freedom of Information Act Request, the MDEQ provided documents pertaining to the management of subsurface landfill gas at the King Highway Landfill (Operable Unit #3). The following documents were received:

- Landfill Gas Monitoring Plan. Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site. King Highway Landfill Operable Unit. BBL, June 2002.
- Draft Final Report for Completion of Construction. Volume 1 of 9. Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site. King Highway Landfill Operable Unit 3. BBL, September 2003.
- Draft-Final Post-Closure Operation and Maintenance Plan. Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site. King Highway Landfill Operable Unit. BBL, October 2003.
- Five-Year Review Report for Allied Paper, Inc./Portage Creek/Kalamazoo River Site. Allegan and Kalamazoo Counties, Michigan. U.S. EPA, 2007.

A review of these documents provided the following information:

- From the late 1950s to 1977, lagoons at the King Highway Landfill were used for dewatering paper residuals (underflow from clarifier).
- From 1987 to 1998, the King Highway Landfill was used to dispose dewatered paper residuals.
- Paper residuals placed within the King Highway Landfill are primarily a mixture of water, clay, and wood fiber.
- A final cover was installed over the landfill and consisted of, from the top of the fill up, a 6-inch–thick gas-venting soil layer, a 40-mil–thick linear low-density polyethylene (LLDPE) flexible membrane liner (FML), a 24-inch–thick barrier protection layer, and a 6-inch–thick vegetative layer.
- Twenty-three passive gas vents, consisting of 4-inch–diameter PVC riser pipes with turbine ventilators were extended into the 6-inch–thick gas-venting soil layer and 4 feet above the final cover. The passive gas vents were spaced at one per acre. There was no mention of the gas vents being connected to piping extending horizontally into the gas-venting soil layer.
- Four landfill gas monitoring probes, located outside the limits of residuals, were installed in April 2002.
- On April 14, 2003, methane was detected above the Lower Explosive Limit (LEL) in the four probes, which was approximately 4 years after the final cover was installed. This appears to be the first time that the probes were monitored.

Summary of Landfill Gas Evaluation

The objectives described in the RD Workplan for collecting additional information to assist in the design of a passive gas venting system at the 12th Street Landfill were met. Although methane was detected in some locations containing paper residuals, there were no general indicators of significant gas generation (e.g., stressed cover vegetation or odors emanating through the cover soil). Landfill gas appears to be generated at a rate that is low enough to effectively be managed with a passive gas venting system. A passive gas venting system should be designed though so that it could be retrofitted into an active gas collection system in the future if monitoring results at

(future) perimeter probes indicate gas is migrating off-site. Sufficient information has been obtained to prepare the remedial design for the landfill.

2.5 Groundwater Level Monitoring

The Plainwell Dam, including the earthen dam adjacent to the landfill and the temporary water control structure that was installed directly downstream of the earthen dam, was scheduled to be removed in the spring of 2008 as part of the second phase of the U.S. EPA-authorized time-critical removal action (TCRA) in the former Plainwell Impoundment, which is being implemented by the Kalamazoo River Study Group (KRSG). At the time the water level measurements were taken as part of the predesign field investigation in June 2008, the earthen dam had been removed, as well as some of the upper logs in the temporary water control structure being used for the TCRA. Although the former powerhouse channel is now part of the main channel of the Kalamazoo River, the remaining lower logs in the water control structure create an approximately 4-foot head drop across the water control structure. This head differential continues to impart a component of radial groundwater flow around the dam. Although it is uncertain when the water control structure will be completely removed from the river, once it is, groundwater in the shallow sand and gravel alluvium at the 12th Street Landfill is expected to return to a more west to east flow direction—without the radial component of flow around the dam.

The groundwater levels in the existing monitoring wells, piezometers, and staff gauges that encircle the landfill were measured on June 11, 2008. The water level data are summarized in Table 3. Figure 2 shows the groundwater elevation and inferred flow direction. Owing to the hydraulic head across the temporary water control structure, the groundwater elevations and flow direction were similar to historical measurements and interpretations. As discussed in the RD Workplan, once the temporary water control structure is completely removed, water levels should be measured approximately biweekly until the groundwater flow direction stabilizes. Based on the relative high hydraulic conductivity of the underlying sand and gravel unit, the groundwater flow regime is expected to stabilize within several weeks of the complete removal of the water control structure.

2.6 Equipment Decontamination

Decontamination of the backhoe excavator arm and bucket, the high-density polyethylene (HDPE) plates used underneath the backhoe tires in the wetland, and the Geoprobe® boring equipment was performed at a temporary decontamination pad that was constructed on top of the landfill. The decontamination pad consisted of an approximate 8-foot by 8-foot piece of HDPE flatstock with 6-inch–high sides. Approximately 40 to 45 gallons of decontamination water were collected and containerized in one 55-gallon barrel that is temporarily being stored on-site. A sample of the decontamination water has been collected and is being tested for the parameters required by a permitted off-site disposal facility. Following receipt of the analytical results, the decontamination water will be transported and disposed at the off-site facility. Documentation of the off-site disposal activities will be submitted to the U.S. EPA under separate cover.

2.7 Sampling Water Supply Well on Asphalt Plant Property

On June 12, 2008, while preparing to complete the soil borings in the area in which the tarry materials had been encountered on the asphalt plant property, RMT and Mateco noticed a plywood box located between Wyoming Asphalt's office trailer and the approximate western limit of the paper residuals on the asphalt plant property, which had just been delineated by soil borings. In order to identify potential underground lines that needed to be avoided by the driller, RMT's field person (Jennifer Overvoorde) contacted Ms. Pat Bailey, the owner of Wyoming Asphalt (the current occupant of the property that is owned by Aggregate Industries), to inquire as to the nature of the plywood box. In a brief conversation, Ms. Bailey told Ms. Overvoorde that the box was covering a well, and that the piping that connected the well to the office trailer did not extend to the east or south, which would have been in the vicinity of the remaining soil borings.

Late on Friday, June 27, 2008, RMT and Mateco were at the asphalt plant property again to complete two test pits as part of the predesign investigation. At the completion of the field activities, Ms. Overvoorde contacted Ms. Bailey to let her know that RMT and Mateco personnel were leaving the site. During that conversation, Ms. Bailey asked whether she should be concerned about the water from the asphalt plant's well.

Weyerhaeuser notified the U.S. EPA of its discovery of the water supply well on the asphalt plant property (voice message from Jennifer Hale to Michael Berkoff on Monday, June 30, 2008). Although not part of the planned predesign field investigation, to allay the concern, on July 1, 2008, Weyerhaeuser requested and received permission from Aggregate Industries (the owner of the asphalt plant property) to collect and analyze a sample of the water in Wyoming Asphalt's well. On July 2, 2008, Weyerhaeuser updated the U.S. EPA regarding the plan to test the water in the well for constituents of potential concern as soon as practicable.

Heavy storms in the area that disabled power delayed the sampling until July 8, 2008, when RMT collected a sample of the groundwater pumped from the well at the faucet in the kitchen sink in Wyoming Asphalt's office trailer. The sample was sent to the Michigan Department of Environmental Quality Drinking Water Laboratory, in Lansing, Michigan, for analysis of volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs) using federal drinking water methods. The analytical results were non-detect for the constituents tested. The laboratory report is contained in Appendix C.

2.8 Evaluation of Potential Need for a Leachate Collection System

As described in the RD Workplan, the potential need for a leachate collection system was evaluated from multiple perspectives, including the following:

- The ability to construct stable sideslopes given the moisture content of the fill materials
- The reduction in leachate generated as a result of the placement of a low-permeability cover liner

- The potential for significantly increasing leachate generation owing to consolidation of the fill materials following placement of additional fill, grading, and cover materials
- The potential for constituents of concern to be transported into the groundwater beneath the landfill at concentrations exceeding relevant criteria
- The practicality of extracting liquids from a relatively low-permeability solid matrix such as wastewater residuals from paper mills
- The U.S. EPA's decision not to require a leachate collection system at the King Highway Landfill (Operable Unit #3 of the Kalamazoo River Superfund Site), which was built and operated in a similar manner as the 12th Street Landfill

As part of the development of the Emergency Response Design Report for the 12th Street Landfill (RMT, 2007), RMT performed slope stability modeling to assess the potential effect of the moisture content of the paper residuals on the stability of the landfill sideslopes following the grading (cuts and fills) needed to reconsolidate residuals within the landfill and to meet the requirements of the State of Michigan solid waste management regulations (Part 115). The slope stability modeling was performed for the most critical slope configuration (4H:1V), assuming saturated fill conditions at the landfill surface. The slope height and geometry that were modeled for the Emergency Response Design Report are similar to those that have preliminarily been developed for the final grading plan that will be presented in the Design Report. The results of the slope stability modeling for the 2007 Emergency Response Plan Design Report (Appendix D) indicate that leachate does not need to be removed from the 12th Street Landfill to achieve stable sideslopes. A detailed slope stability analysis for the final landfill slopes will be included in the Design Report.

Moreover, after excavating paper residuals outside the footprint of the landfill and relocating these materials back into the landfill, a final cover will be constructed over the fill materials further reducing the potential for leachate generation. As required by the Record of Decision (ROD) for the 12th Street Landfill, the final cover will include a barrier layer specifically designed to limit infiltration. The type of membrane material proposed, and preliminarily accepted by, the U.S. EPA is a linear low-density polyethylene (LLDPE) geomembrane liner at least 30 mils thick (in lieu of the PVC liner specified in the ROD). This will create a final cover with a permeability that is up to seven orders of magnitude lower than the permeability of the existing cover soil, which consists of soil, sand, and fly ash. Consequently, the new cover liner will significantly reduce the amount of leachate being generated by reducing the amount of precipitation infiltrating the cover.

Calculations were performed (refer to Appendix E) to estimate the rates of leachate generation from the landfill as a result of the consolidation of fill materials following the placement of the relocated residuals from outside the footprint of the landfill and the placement of the final cover materials on top of the landfill. These calculations were used to evaluate the environmental significance of constituents of potential concern in the leachate entering the groundwater flow system beneath the landfill at a higher rate than under existing (pre-final cover) conditions.

While an increase in leachate generation may occur as a result of the grading and cover placement activities, most of this increase would be of limited duration (less than a year) and would be off-set by the significantly decreased amount of infiltration of precipitation through the fill materials once the low-permeability LLDPE cover barrier layer is installed. As shown in Appendix E, the estimated average rate of leachate generation during an 8-week–long construction period is approximately 0.2 gallons per minute (gpm). This rate is reduced to an average of approximately 0.1 gpm during the first year following placement of the final cover. The estimated average rate of leachate generation following placement of the final cover is biased high because it does not take into account the reduction of precipitation infiltrating into the landfill once the final cover is installed. Neither of these estimated rates is of environmental significance because the constituents of primary concern at this site are PCBs, which are unlikely to be present in the leachate owing to their high affinity to solid matrices (paper residuals and soil). Moreover, groundwater samples, collected as part of the remedial investigation in 1994, did not identify PCBs or other constituents of potential concern in groundwater (G&M, 1994b). In addition, groundwater quality downgradient of the landfill will be monitored as part of the post-construction monitoring program required by the ROD.

Furthermore, it is not common paper industry practice to install vertical leachate extraction wells in landfills containing paper residuals because the low hydraulic conductivity of the paper residuals (on the order of 1×10^{-6} centimeters/second [cm/s] to 1×10^{-8} cm/s) makes extraction of significant amounts of liquids impractical. Typically, wastewater residuals at paper mills are dewatered for several months in lagoons or on a mechanical press prior to being disposed of in a landfill.

Based on the information presented above, and consistent with the U.S. EPA's determination that a leachate collection system was not needed at the King Highway Landfill (Operable Unit #3), Weyerhaeuser does not believe that a leachate collection system is needed at the 12th Street Landfill.

Although Weyerhaeuser does not believe a leachate collection system is needed at the 12th Street Landfill, perched liquid within the landfill may be removed as part of the Remedial Action construction activities. Areas in which perched liquid may be present based on previous field investigations, will be identified in the Design Report.

As described above, the potential need for a leachate collection system was evaluated from multiple perspectives, summarized as follows:

- Slope stability modeling indicates that leachate does not need to be removed from the 12th Street Landfill to achieve stable sideslopes.
- The new cover liner (LLDPE geomembrane) will have a permeability of up to seven order of magnitude less than the existing cover materials. This will reduce the amount of leachate being generated by reducing the amount of precipitation infiltrating the cover.
- The estimated average rate of leachate generation during construction is 0.2 gpm. The estimated average rate of leachate generation during the first year following placement of the final cover is

0.1 gpm. The post-cover estimated average rate is biased high because it does not take into account the reduction of precipitation infiltrating into the landfill once the final cover is installed.

- The primary constituents of concern at this site are PCBs, which are unlikely to be present in the leachate owing to their high affinity to solid matrices (paper residuals and soil). Moreover, groundwater samples, collected as part of the remedial investigation in 1994, did not identify PCBs or other constituents of potential concern in groundwater (G&M, 1994b).
- It is not common paper industry practice to install vertical leachate extraction wells in landfills containing paper residuals because the low hydraulic conductivity of the paper residuals (on the order of 1×10^{-6} to 1×10^{-8} cm/s) makes extraction of significant amounts of liquid impractical.
- The U.S. EPA determined that a leachate collection system was not needed at the King Highway Landfill (Operable Unit #3).
- It is not necessary to extract leachate from the 12th Street Landfill in order to implement the construction activities; although, if pockets of perched liquid are encountered during the grading activities, they will be removed to the extent practical.

Consequently, a leachate collection system will not be incorporated into the design for the remedial action for the 12th Street Landfill.

Section 3
Recommendations

On the basis of the information collected as part of the Predesign Studies, Weyerhaeuser recommends that the following information be incorporated in the design for the remedial action for the 12th Street Landfill operable unit:

- Develop the excavation plan based on the areal delineation and depth of paper residuals outside the footprint of the landfill. Develop a grading plan for the landfill that will contain all paper residuals on the 12th Street Landfill property.
- Because the paper residuals were found to be readily distinguishable from native soil, determine the final limits of excavation in the field based on visual observation.
- Work with the State of Michigan (MDNR) to coordinate excavation of paper residuals on the state-owned property to the southeast of the landfill and the regrading/restoration of disturbed areas. Conduct soil verification sampling to confirm that the remaining underlying soil meets the State of Michigan Part 201 generic residential cleanup criteria.
- Work with the owner of the asphalt plant property (Aggregate Industries) and the operator of the asphalt plant (Wyoming Asphalt) to coordinate excavation of paper residuals on the asphalt plant property and the regrading/restoration of disturbed areas. Conduct soil verification sampling to confirm that concentrations of constituents of potential concern in the remaining underlying soil do not exceed the criteria that define a "facility" in the State of Michigan (i.e., the Part 201 generic residential cleanup criteria).
- Work with the owner of the gas pipeline that runs underneath the landfill (Major Pipeline, LLC), Aggregate Industries, and the operator of the asphalt plant (Wyoming Asphalt) to develop a plan for maintaining the pipeline that runs onto the asphalt property and possibly underneath the paper residuals identified on that property.
- Incorporate a passive gas venting system into the design for the landfill cover. Include design flexibility to convert this passive venting system to an active gas extraction system in the future, should monitoring of (future) gas probes at the landfill property boundaries detect methane above the Lower Explosive Limit.
- Although it is not necessary to install a leachate collection system, as part of the construction planning activities, as practicable, prepare to remove pockets of perched liquid that may be encountered during the grading activities. Survey and mark in the field those areas of construction debris in which perched liquids were encountered during the 1994 test pit investigation conducted by Geraghty & Miller.

Section 4
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Table 1
Summary of Observations Made at Test Pits
Predesign Investigation
12th Street Landfill Operable Unit, Otsego Township, Michigan

TEST PIT	LOCATION	DIMENSIONS (ft x ft)	DEPTH OF SURFACE WATER (if present) (ft)	SUMMARY OF OBSERVATIONS
RDTP-01	Wetland	15 x 3 ft	0.3 to 0.5 ft	Approximately 3 to 6 inches of surface water covered the paper residuals or native wetland soil at this test pit location. Paper residuals were either directly below the surface water or covered with approximately 0.5 to 1.0 foot of organic topsoil. The paper residuals were gray, overlayed with a yellowish-brown clayey organic soil or peat, and were approximately 3 feet thick closer to the landfill and became thinner (less than ½ inch) near the identified limits of visible paper residuals. Paper residuals were easily distinguishable from the native soil based on color and consistency. Paper residuals were layered within the peat/topsoil and were becoming thinner at the westernmost end of RDTP-01 (the end furthest from the landfill), which indicated that the limits of visible paper residuals were near, less than a few feet away. However, due to surface water entering into the excavation (refer to Photograph 1 in Appendix B), RMT and U.S. EPA's field oversight contractor agreed that the objectives of the investigation at this location had been met, and the excavation of this test pit was therefore halted.
RDTP-02	Wetland	10 x 1.5 ft	0 to 0.2 ft	Where present, paper residuals were visible on the ground surface (refer to Photograph 2 in Appendix B), light gray, and overlayed a dark-gray topsoil. Paper residuals were approximately 8 inches thick closer to the landfill and were not visible beyond the identified limits of visible paper residuals. Paper residuals were easily distinguishable from the native soil based on color and consistency. Although the depth to water where paper residuals were present was approximately 1 foot bgs, approximately 2 inches of surface water were present at the northern end (the end furthest from the landfill) of the test pit.

Table 1 (continued)
Summary of Observations Made at Test Pits
Predesign Investigation
12th Street Landfill Operable Unit, Otsego Township, Michigan

TEST PIT	LOCATION	DIMENSIONS (ft x ft)	DEPTH OF SURFACE WATER (if present) (ft)	SUMMARY OF OBSERVATIONS
RDTP-03	Wetland	9 x 1.5 ft	No standing water present	Where present, paper residuals were visible on the ground surface or were covered with a thin (less than 1 inch thick) layer of forest litter (i.e., decaying leaves and branches mixed with occasional topsoil). The paper residuals were light gray, overlayed a poorly graded yellowish-brown sand, and were approximately 8 inches thick closer to the landfill and were not visible beyond the identified limits of visible paper residuals. Below the yellowish-brown sand, a brown to grayish-brown clayey sand was present. Paper residuals were easily distinguishable from the native soil based on color and consistency. The depth to water at this location was approximately 1.5 feet bgs.
RDTP-04	MDNR property	8 x 1.5 ft	No standing water present	Where present, paper residuals were visible on the ground surface, or covered with a thin (less than 1 inch thick) layer of forest litter (i.e., decaying leaves and branches mixed with occasional topsoil). Paper residuals were light gray, overlayed a poorly graded yellowish-brown sand, and were approximately 6 to 8 inches thick closer to the landfill and were not visible beyond the identified limits of visible paper residuals. Paper residuals were easily distinguishable from the native soil (grayish-brown topsoil and yellowish-brown sand) based on color and consistency.
RDTP-05	MDNR property	15 x 1.5 ft		
RDTP-06	MDNR property	10 x 1.5 ft		
RDTP-07	MDNR property	5 x 1.5 ft		
RDTP-08	Asphalt plant property	5 x 3 ft	No surface water present	During the excavation of the original test pit at RDTP-08 on June 11, 2008, several unmarked utility lines (phone and electric) were encountered, but appeared to not be in use. No paper residuals were observed within the upper 2 feet of the test pit excavation. Rather than risking the backhoe bucket discovering more unmarked utilities, hand-augered borings were advanced in an attempt to verify the limits of paper residuals in this location. It was also agreed between RMT and the U.S. EPA's field oversight contractor that the location of the underground utility lines in this area needed to be confirmed and located and marked in the field.

Table 1 (continued)
Summary of Observations Made at Test Pits
Predesign Investigation
12th Street Landfill Operable Unit, Otsego Township, Michigan

TEST PIT	LOCATION	DIMENSIONS (ft x ft)	DEPTH OF SURFACE WATER (if present) (ft)	SUMMARY OF OBSERVATIONS
RDTP-08 (*continued*)				Hand-augered borings at multiple locations in the vicinity of RDTP-08 (not shown on Figure 1 to simplify the figure) did not encounter paper residuals, and the second utility locate verified that the utilities were not being used. Therefore, the original plan was followed and the backhoe was used to verify the limits of paper residuals in this area. This activity was performed on June 12, 2008. Where present, paper residuals were covered by approximately 6 inches of dark-brown topsoil with gravel, gray in color, approximately 0.5 foot thick, and overlayed a brown sand with gravel. The paper residuals were easily distinguishable from the native soil based on color and consistency.
RDTP-09	Asphalt plant property	9 x 3 ft	No standing water present	Paper residuals were covered by approximately 0.5 to 1.0 foot of topsoil with gravel, and approximately 2 inches of asphalt. Paper residuals were light gray and approximately 10 feet thick. Decaying vegetation (cattails) was visible at approximately 11 feet bgs. Paper residuals were easily distinguishable from the native soil based on color and consistency. Because a thicker-than-anticipated deposit of paper residuals was observed (refer to Photograph 3 in Appendix B) at test pit RDTP-09, it was agreed between RMT and the U.S. EPA that the southern, western, and northern extent of the paper residuals at this location should be verified with Geoprobe® borings rather than test pits to avoid tearing up a large section of a paved parking area on the asphalt plant property. Consequently, nine Geoprobe® borings (RDB-12 through -20) were advanced to 15 feet bgs at the locations shown on Figure 1 to delineate the paper residuals at RDTP-09 (refer to Photograph 4 in Appendix B). The findings at the nine Geoprobe® soil borings (RDB-12 through RDB-20) are as follows: ▪ Paper residuals were found in five of the nine borings (RDB-12, -13, -14, -19, and -20) and were 1 to 7.5 feet thick. ▪ Paper residuals were overlain by varying amounts of granular fill and asphalt.

Table 1 (continued)
Summary of Observations Made at Test Pits
Predesign Investigation
12th Street Landfill Operable Unit, Otsego Township, Michigan

TEST PIT	LOCATION	DIMENSIONS (ft x ft)	DEPTH OF SURFACE WATER (if present) (ft)	SUMMARY OF OBSERVATIONS
RDTP-09 (continued)				▪ A tarry material (likely asphalt) was found to be commingled with paper residuals at 4.5 feet bgs at RDB-12. Historical information does not suggest that tarry materials would have been disposed in the landfill as part of the papermaking processes. ▪ At various depths, petroleum odors were identified as emanating from the asphalt, granular fill, paper residuals, and/or the native sand and gravel at soil borings RDB-12 through RDB-20. The source of the petroleum odors was not identified.
RDTP-10	Asphalt plant property	6 x 3 ft	0.5 to 1.5 ft	Prior to using a backhoe at RDTP-10, and after consultation with the U.S. EPA project manager, a field decision was made to use hand-augered borings rather than excavating a test pit with a backhoe because the utility locator service (Miss Dig) was not aware of an underground natural gas pipeline that was generally marked in the area. The owner of the gas pipeline needed to locate and mark the line before a backhoe could be used in this area. Also, since hand-augered borings were used in this area during a previous investigation, it was expected that only a couple of borings would be needed to define the limits of visible paper residuals. After what appeared to be paper residuals were found in five hand-augered borings on June 11, 2008 (with each location moving more westerly), it was agreed upon between RMT and the U.S. EPA's project manager to have the natural gas pipeline marked and to use a backhoe to excavate the test pit.

Table 1 (continued)
Summary of Observations Made at Test Pits
Predesign Investigation
12th Street Landfill Operable Unit, Otsego Township, Michigan

TEST PIT	LOCATION	DIMENSIONS (ft x ft)	DEPTH OF SURFACE WATER (if present) (ft)	SUMMARY OF OBSERVATIONS
RDTP-10 (continued)				The natural gas pipeline was marked by Major Pipeline, LLC, on June 24, 2008; and test pit RDTP-10 was excavated with a backhoe on June 27, 2008 (Photograph 5 in Appendix B). The excavation performed with the backhoe showed that the limits of the paper residuals were actually closer to the landfill than previously thought based on the hand-augured borings performed on June 11, 2008. The material that was thought to be paper residuals identified in the hand-augered borings was reclassified in the test pit excavation as a brown, mottled clay with gray and black streaks that appeared to be associated with decaying organic matter. The U.S. EPA's oversight contractor concurred with the reclassification. Paper residuals were covered by approximately 6 inches of organic topsoil. Approximately 0.5 to 1.5 feet of surface water covered the native soil at the test pit location (refer to Photograph 6 in Appendix B). Paper residuals may also be present underneath the asphalt berm directly south of this test pit location and contiguous with the paper residuals found further south on the asphalt plant property. Paper residuals were gray, approximately 3.5 feet thick, and overlayed peat. After the gray paper residuals were found, the paper residuals were easily distinguishable from the native brown mottled clay soil based on color. The location of the underground natural gas pipeline is shown on Figure 1. The Right-of-Way agreement for this pipeline indicates that it was installed in approximately 1957. The pipeline was installed approximately 3 feet below the then-current ground surface. Historical aerial photographs show that paper residuals/fill materials were placed over the pipeline after the pipeline was installed.

Table 1 (continued)
Summary of Observations Made at Test Pits
Predesign Investigation
12th Street Landfill Operable Unit, Otsego Township, Michigan

TEST PIT	LOCATION	DIMENSIONS (ft x ft)	DEPTH OF SURFACE WATER (if present) (ft)	SUMMARY OF OBSERVATIONS
RDTP-11	Asphalt plant property	10 x 3 ft	No surface water present	In light of the findings at RDTP-01 and -10, the U.S. EPA requested an additional test pit (RDTP-11) to be excavated approximately equal distance between these two test pits and along the areal limits of visible paper residuals outside the footprint of the landfill that were delineated based on information from previous investigations (G&M, 1994b and U.S. EPA, 2004). At RDTP-11, paper residuals were covered by approximately 6 inches of a black silty sand. This material may be fly ash similar to that observed in the soil borings advanced on top of the landfill on June 9-11, 2008. No surface water was encountered at this test pit location. Paper residuals were gray, approximately 3.5 feet thick, and overlayed peat. Paper residuals were easily distinguishable from the native soil based on color and consistency.

Table 2
Landfill Gas Monitoring Data
12th Street Landfill

MONITORING POINT	MONITORING DEPTH (ft below ground surface)	% METHANE, CH_4	% CARBON DIOXIDE, CO_2	% OXYGEN, O_2	% BALANCE GAS[1]	PRESSURE (in. W.C.)
Geoprobe® Borings						
RDB-01	15.0	0.0	5.1	13.8	81.1	NM
RDB-02	15.0	0.0	9.9	7.8	82.3	NM
RDB-03	18.0	24.7	23.7	0.0	51.6	NM
RDB-04	15.0	16.9	8.2	0.0	74.9	NM
RDB-05	15.0	0.0	0.9	19.0	80.1	NM
RDB-06	15.0	0.0	2.0	18.9	79.1	NM
RDB-07	20.0	0.9	0.7	18.9	79.5	NM
RDB-08	25.0	8.5	15.0	0.0	76.5	NM
RDB-09	22.0	14.8	27.0	0.0	58.2	NM
RDB-10	10.0	0.0	2.1	18.6	79.3	NM
RDB-11	10.0	0.0	9.7	10.0	80.3	NM
Groundwater Monitoring Wells						
MW-6A	NA	0.2	1.4	18.7	79.7	0.0
MW-7A	NA	0.0	3.9	15.3	80.8	0.0
MW-8A	NA	0.0	0.7	19.7	79.6	0.0

Notes:

NA = not applicable.

NM = not measured. Pressure is not measured in the Geoprobe® borings.

(1) The % Balance Gas represents the nitrogen content of the gas, as the trace gases typically make up much less than 1 percent of the total gas collected.

Created by: Cal Dunham, 6/18/2008

Checked by: Eric Watruba, 6/23/2008

Table 3
Water Level Data
12th Street Landfill

WELL	GROUND SURFACE (previous survey) (ft M.S.L.)	TOP OF CASING (previous survey) (ft M.S.L.)	TOP OF CASING (surveyed 6/11/08) (ft M.S.L.)	CHANGE IN TOP OF CASING (ft)	DEPTH TO WATER (ft below TOC)	WATER ELEVATION (6/11/2008) (ft M.S.L.)
Wells Located Inside the Footprint of the Landfill						
MW-1	706.20	708.71	708.49	-0.22	5.20	703.29
MW-2A	704.90	707.31	707.27	-0.04	4.98	702.29
MW-2B	704.10	706.97	706.85	-0.12	4.24	702.61
MW-3A	702.30	704.25	704.37	0.12	3.02	701.35
MW-3B	702.50	704.54	704.63	0.09	3.29	701.34
MW-4A	703.70	706.01	706.11	0.10	5.11	701.00
MW-4B	703.60	705.61	705.70	0.09	4.68	701.02
MW-5A	702.10	704.07	704.10	0.03	3.20	700.90
MW-5B	702.30	704.18	704.20	0.02	2.96	701.24
Wells Located Outside the Footprint of the Landfill						
MW-6A	708.30	710.33	710.37	0.04	8.46	701.91
MW-6B	708.20	710.21	710.25	0.04	8.50	701.75
MW-7A	707.70	709.92	709.95	0.03	7.18	702.77
MW-7B	708.10	710.82	710.85	0.03	8.06	702.79
MW-8A	733.20	734.96	735.09	0.13	31.51	703.58
MW-8B	733.00	734.89	735.02	0.13	31.50	703.52
Piezometers						
PZ-1	NM	702.62	NM	NA	2.51	700.11
PZ-2	NM	701.84	NM	NA	1.73	700.11
PZ-3	NM	702.18	NM	NA	NM(1)	NA
Staff Gauges						
SG-1(2)	700.60	NA	NM	NA	Dry	< 700.60
SG-2(2)	701.10	NA	NM	NA	Dry	< 701.10
SG-3(2)	700.20	NA	NM	NA	Dry	< 700.20
SG-4(2)	699.30	NA	NM	NA	Dry	< 699.30
SG-5(2)	700.10	NA	NM	NA	Dry	< 700.10
SG-6(2)	699.50	NA	NM	NA	NM(1)	NA
SG-7(2)	700.20	NA	NM	NA	Dry	< 700.20
SG-8(2)	700.00	NA	NM	NA	0.72	700.72
SG-9(2)	701.30	NA	NM	NA	Dry	< 701.30
SG-River(3)	NA	702.43	NM	NA	1.62	700.81
SG-Swamp(3)	NA	699.50	NM	NA	1.23	698.27

Notes:

NM = not measured.

NA = not applicable.

(1) Piezometer PZ-3 and staff gauge SG-6 were not measured because they could not be located in the field.

(2) Water elevation for staff gauges SG-1 through SG-9 is calculated by adding "Depth to Water" height to the "Ground Surface" elevation.

(3) For SG-River and SG-Swamp, the water elevation is calculated by subtracting "Depth to Water" height from the "Top of Casing" elevation.

On June 11, 2008, The Kalamazoo River was flowing over both the temporary water control structure and the concrete spillway at approximately 1,990 cubic feet per second (cfs), according to the United States Geological Survey's data for the Comstock, Michigan, station (http://waterdata.usgs.gov/mi/nwis/current/?type=flow).

Created by: Cal Dunham, 6/17/2008

Checked by: Eric Watruba, 6/20/2008

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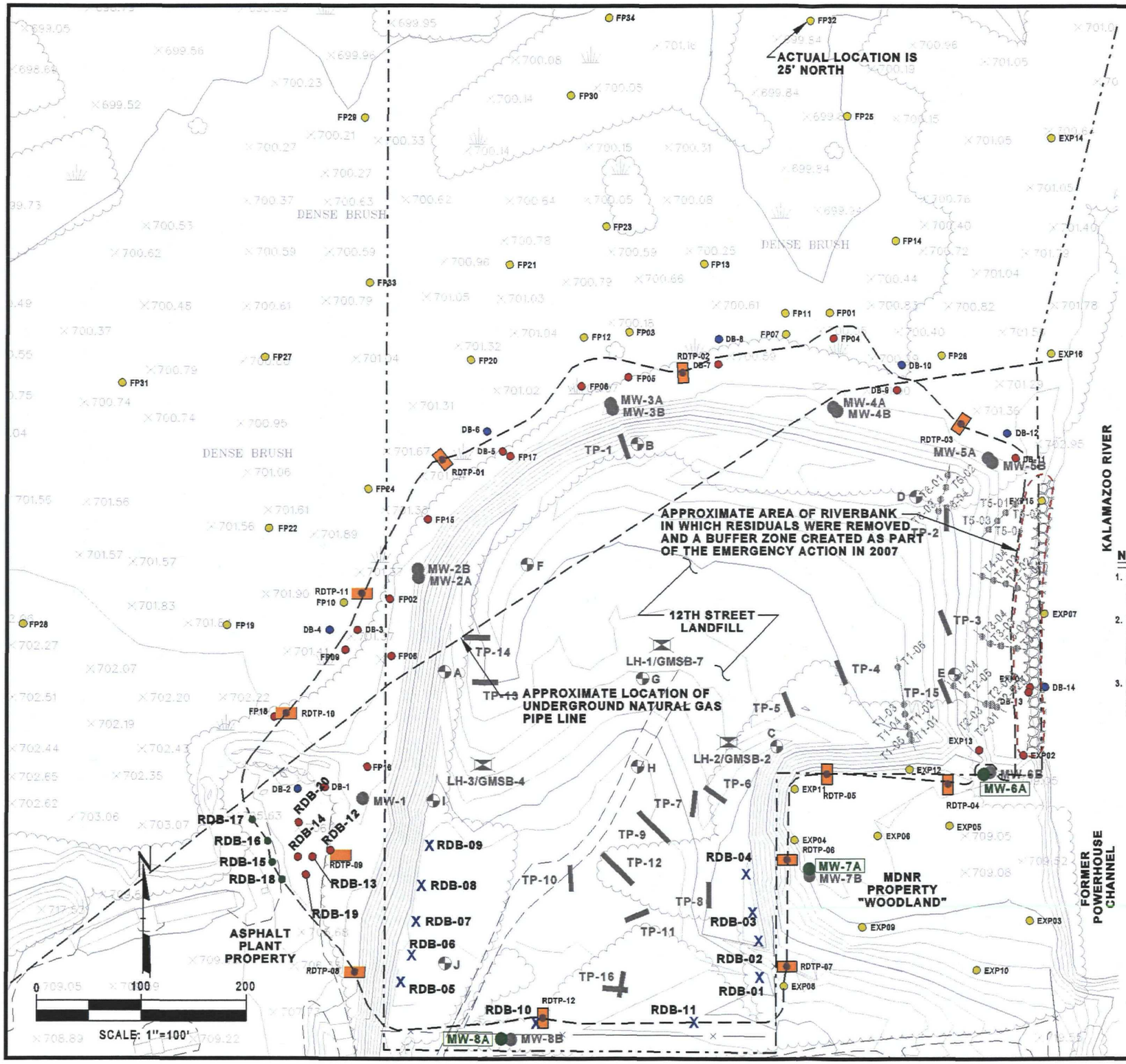

LEGEND

- RDTP-01 — TEST PIT AND LIMITS OF VISIBLE PAPER RESIDUALS IDENTIFIED DURING 2008 PREDESIGN INVESTIGATION
- 2003 BORING IN WHICH VISIBLE PAPER RESIDUALS WERE NOT PRESENT IN UPPER 24 INCHES (U.S. EPA, 2004)
- 1994 BORING (DB SERIES [G&M, 1994b]), 2003 BORING (FP AND EXP SERIES [U.S. EPA, 2004], AND 2008 PREDESIGN INVESTIGATION BORING (RDB SERIES) IN WHICH VISIBLE PAPER RESIDUALS WERE DOCUMENTED IN BORING LOGS
- 1994 BORING IN WHICH VISIBLE PAPER RESIDUALS WERE PRESUMED TO NOT HAVE BEEN IDENTIFIED (GIVEN THE OBJECTIVE OF THE INVESTIGATION), BUT WERE NOT DOCUMENTED (BORING LOGS ARE NOT AVAILABLE) (G&M, 1994)
- 2008 GEOPROBE BORING IN WHICH VISIBLE PAPER RESIDUALS WERE NOT PRESENT
- X RDB-01 — 2008 GEOPROBE BORING WITHIN LANDFILL
- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE LIMITS OF VISIBLE PAPER RESIDUALS
- EXISTING UNPAVED ROAD
- EXISTING FENCE
- EXISTING BUILDING
- EXISTING 10' CONTOUR
- EXISTING 2' CONTOUR
- EXISTING SPOT ELEVATION
- EXISTING TREES AND/OR BRUSH
- EXISTING WETLAND LIMITS
- EXISTING OVERHEAD ELECTRIC
- MW-10 — EXISTING MONITORING WELL
- MW-6A — EXISTING MONITORING WELL SCREENED IN VADOSE ZONE (LANDFILL GAS MONITORING LOCATION)
- F — 2001 SOIL BORING (BBL,2001)
- LH-1/GMSB-7 — EXISTING LEACHATE HEADWELL
- TP-14 — 1994 TEST PIT (G&M, 1994a)
- T5-01 — 2007 GEOPROBE BORING (RMT, 2007)

NOTES

1. BASE TOPOGRAPHY PROVIDED BY OAS, INC. OF SEYMOUR, INDIANA BASED ON AERIAL SURVEY ON 3/30/2005. TOPOGRAPHY FOR THE EASTERN LANDFILL SIDESLOPE AND RIVERFRONT ADJACENT TO THE LANDFILL PROVIDED BY HOLLAND ENGINEERING, INC. SURVEY DATE: DECEMBER 6, 2007.
2. THE APPROXIMATE LIMITS OF VISIBLE RESIDUALS WAS DERIVED FROM THE ALLIED PAPER, INC,/PORTAGE CREEK / KALAMAZOO RIVER SUPERFUND SITE REMEDIAL INVESTIGATION, TECHNICAL MEMORANDUM 8, (GERAGHTY AND MILLER, INC. MAY 31, 1994) AND REVISED BASED ON THE U.S.EPA'S 2003 PREDESIGN INVESTIGATION, THE EMERGENCY ACTIONS PERFORMED ALONG THE RIVERBANK IN 2007, AND THE PREDESIGN INVESTIGATION CONDUCTED IN JUNE 2008.
3. PROPERTY BOUNDARY BASED ON LEGAL DESCRIPTION PROVIDED BY THE U.S.EPA ON MARCH 30, 2004. COORDINATES FOR S1/4 CORNER AND N 1/4 CORNER OF SECTION 24 AND NORTH BEARING USED TO PLOT PROPERTY LINE WERE PROVIDED BY HOLLAND ENGINEERING AND ARE BASED ON MICHIGAN STATE PLANE-SOUTH ZONE, COORDINATES. THE VERTICAL DATUM IS NGVD 29.

PROJECT: **12TH STREET LANDFILL PREDESIGN INVESTIGATION OTSEGO TOWNSHIP, MICHIGAN**

SHEET TITLE: **LANDFILL, WETLAND, WOODLAND, AND ASPHALT PLANT AREA PREDESIGN INVESTIGATIONS**

DRAWN BY: stormerl	SCALE: 1"=100'	PROJ. NO.	5117.08
CHECKED BY: ECW		FILE NO.	BORINGS.PLT
APPROVED BY: LEH	DATE PRINTED: AUG 07 2008	FIGURE	1
DATE: AUGUST 2008			

RMT
744 Heartland Trail
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P.O. Box 8923 53708-8923
Phone: 608.831.4444
Fax: 608.831.3334

Design Log
stormerl Plot Date - Wed Aug 06 09:53:36 2008
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Ref. File 4 - J:\05117\08\11x17bdr.dgn
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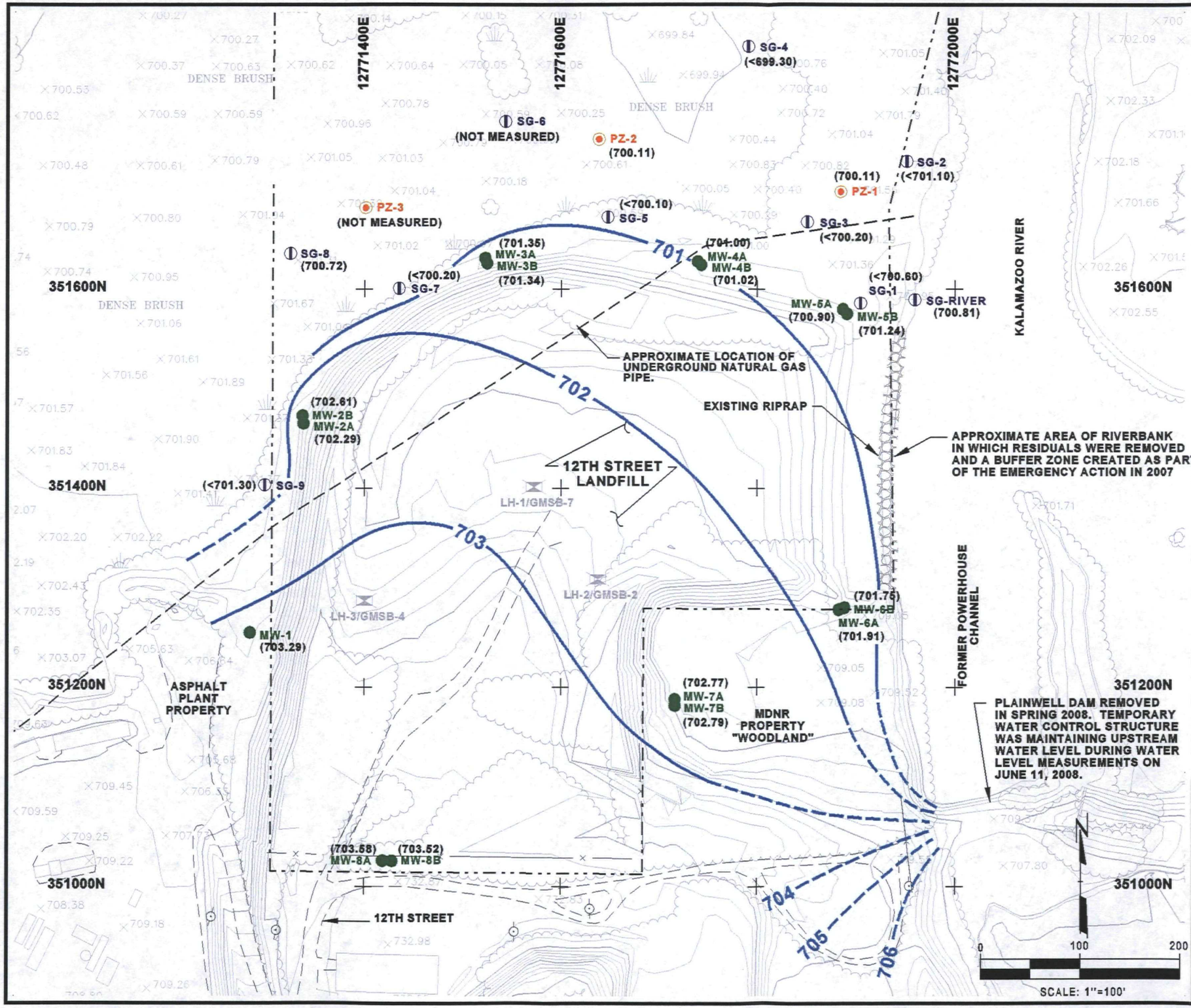

LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- GRID LOCATION
- EXISTING UNPAVED ROAD
- EXISTING FENCE
- EXISTING BUILDING
- EXISTING 10' CONTOUR
- EXISTING 2' CONTOUR
- EXISTING SPOT ELEVATION
- EXISTING TREES AND/OR BRUSH
- EXISTING WETLAND
- EXISTING OVERHEAD ELECTRIC
- MW-1 EXISTING MONITORING WELL
- SG-3 EXISTING STAFF GAUGE
- LH-1/GMSB-7 EXISTING LEACHATE HEADWELL
- PZ-1 EXISTING PIEZOMETER
- 701 WATER TABLE CONTOUR (DASHED WHERE INFERRED)

NOTES

1. BASE TOPOGRAPHY PROVIDED BY OAS, INC. OF SEYMOUR, INDIANA BASED ON AERIAL SURVEY ON 3/30/2005. TOPOGRAPHY FOR THE EASTERN LANDFILL SIDESLOPE AND RIVERFRONT ADJACENT TO THE LANDFILL PROVIDED BY HOLLAND ENGINEERING, INC. SURVEY DATE: DECEMBER 6, 2007.
2. COORDINATES ARE MICHIGAN STATE PLANE-SOUTH ZONE. THE VERTICAL DATUM IS NGVD 29.
3. PROPERTY BOUNDARY BASED ON LEGAL DESCRIPTION PROVIDED BY U.S.EPA ON MARCH 30, 2004. COORDINATES FOR S 1/4 CORNER AND N 1/4 CORNER OF SECTION 24 AND NORTH BEARING USED TO PLOT PROPERTY LINE WERE PROVIDED BY HOLLAND ENGINEERING AND ARE BASED ON MICHIGAN STATE PLANE - SOUTH ZONE COORDINATES.
4. WATER LEVELS WERE MEASURED BY RMT, INC., ON JUNE 11, 2008.
5. ON JUNE 11, 2008, THE KALAMAZOO RIVER WAS FLOWING OVER BOTH THE TEMPORARY WATER CONTROL STRUCTURE AND THE CONCRETE SPILLWAY AT APPROXIMATELY 1,990 CUBIC FEET PER SECOND (cfs), (UNITED STATES GEOLOGICAL SURVEY'S DATA FOR THE COMSTOCK, MICHIGAN STATION [http://waterdata.usgs.gov/mi/current/?type=flow]).

PROJECT: **12TH STREET LANDFILL PREDESIGN INVESTIGATION OTSEGO TOWNSHIP, MICHIGAN**

SHEET TITLE: **JUNE 2008 WATER CONTOUR MAP (PRE-WATER CONTROL STRUCTURE REMOVAL)**

DRAWN BY: stormerl	SCALE: 1"=100'	PROJ. NO.	5117.08
CHECKED BY: ECW		FILE NO.	GW CONT.PLT
APPROVED BY: LEH	DATE PRINTED: AUG 07 2008	FIGURE	2
DATE: AUGUST 2008			

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APPENDIX A

Appendix A
Field Notes and Soil Boring and Test Pit Logs

12TH STREET LANDFILL
PREDESIGN STUDIES

WK OF 6/9/08

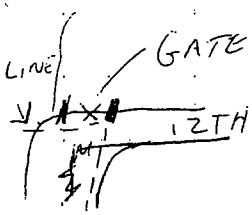
RMT - ERIC WATRUBA
- JENNIFER OVERVOORDE

6/9/08
1/7

12TH ST LF
- ONSITE AT 720
- J. OVERVOORDE ONSITE AT 915

WEATHER (720)
LT. RAIN, 70F, WIND - SSW 0-5 MPH
GROUND - SATURATED), SOME PONDED WATER ON LANDFILL SURFACE

745 - RAIN STOPPED
~~845~~ 835 - MICHIGAN GAS UTILITIES ONSITE TO MARK GAS LINE BY SITE ENTRANCE (REQUEST BY MATECO)



2/7

GAS PIPE TO NORTH OF LF → CONSUMERS?

845 - INSTALLED LABCOCK VALVE AT MW-8A

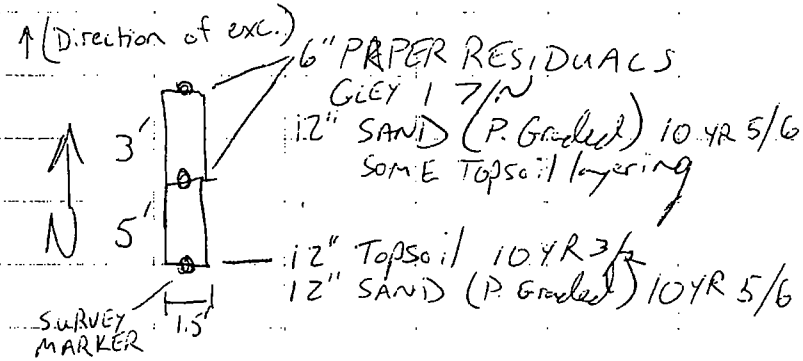
930 - MATECO ONSITE
OPER - TODD
STEVE
VINCE BENNETT
EQUIP - TRACK-MOUNTED GEOPROBE RIG
- KUBOTA L5412 RUBBER-TIRE BACKHOE (W/ FRONT BUCKET)

1010 CALLED IAN MILLER (SP?) (CH2MHILL) 414-405-1622
INFORMED IAN THAT WE ARE STARTING TEST PITS ON MDNR PROPERTY. IAN SAID THAT WAS OKAY AND HE WOULD BE

3/7

ONSITE AT APPROX. 1100.

1040 - 1100 EXCAVATED TP-04
MINIRAM - 0.01 mg/kg
BACKGROUND - 0.01 mg/kg



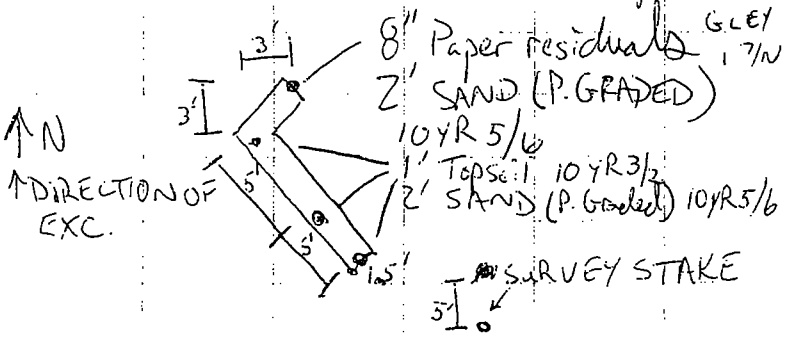
- No gross contamination on equipment

1100 IAN MUELLER (CH2MHILL)
ONSITE
- OVERSEEING TEST PIT EXCAVATIONS

4/7

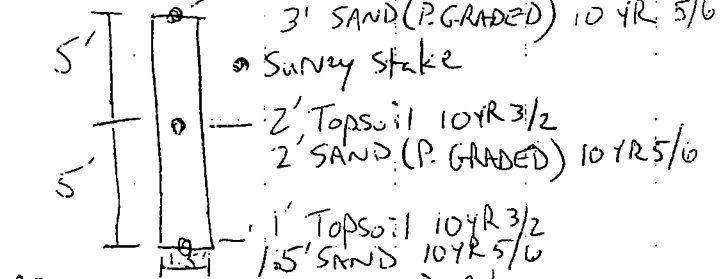
1105 - 1120 EXCAVATED TP-05

MINIRAM - 0.03 mg/kg



- NO GROSS CONTAMINATION ON EQUIPMENT
- ROOT STRUCTURE DAMAGED AT 2 TREES (MARKED W/ PINK SPRAY PAINT)

1135 - 1155 EXCAVATED TP-06



↑ DIR. OF EXCAVATION, → N

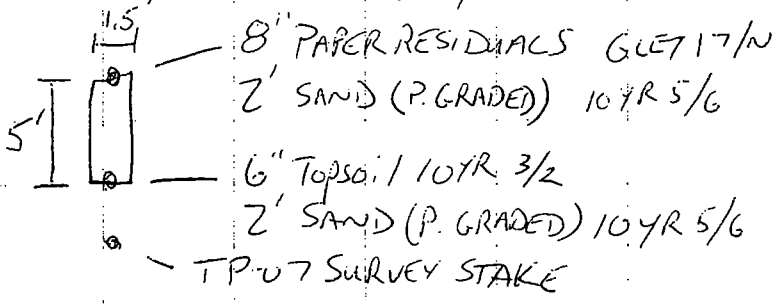
- NO GROSS CONTAMINATION ON EQUIP.

5/7

MINIRAM - 0.03 mg/kg

1205 - 1215 EXCAVATED TP-07

MINIRAM - 0.03 mg/kg



→ N, ↑ DIRECTION OF EXCAVATION

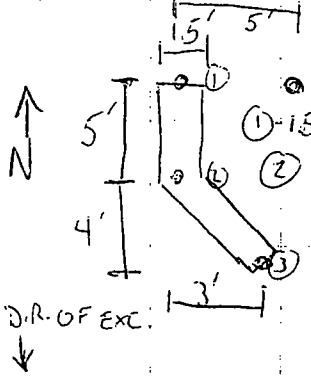
- NO GROSS CONTAMINATION ON EQUIPMENT

1215 - 1315 - LUNCH

1315 - INSTALLED LABCOCK VALVE ON MW-7A AND MW-6A

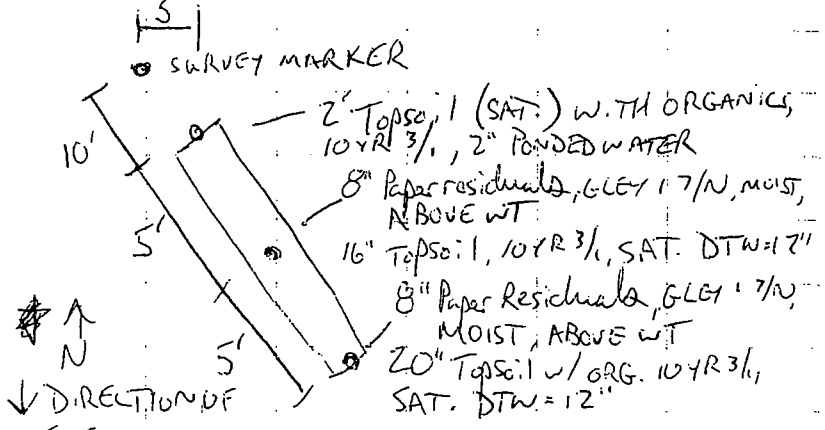
6/7

1340-1410 EXCAVATED TP-03



- TEST PIT REMAINED OPEN EVEN WITH WATER AT BOTTOM OF EXCAVATION
- NO GROSS CONT. ON EQUIPMENT

1435-1500 EXCAVATED TP-02



7/7

- PONDED WATER WAS CAUSING EXCAVATION TO CAVE IN QUICKLY

1500-1530 REMOVED GROSS CONTAMINATION ~~FROM~~ FROM BKT - SCRAPED OFF W/ BRUSH, WASHED WITH CLEAN WATER AND SOAP

1530-1630 - MOVED BACKHOE TO TP-01

1645 LT RAN

1700 IAN, J. OVERWORDE OFFSITE,

1715 MATECO OFFSITE

SUMMARY

TP's - 02, 03, 04, 05, 06, 07

GEOPROBES - 07, 08, 09

RIPRAP ALONG RIVER - IN GOOD SHAPE

1740 OFFSITE

6/10/08 1/1

12TH ST LF

650 - ONSITE

WEATHER - RAIN, 65F, WIND - CALM

GROUND - SATURATED, SOME PONDED WATER ON LF

715 - MATECO ONSITE

730 - IAN ONSITE

805 START GEOPROBE AT RDB-06

930 WEATHER - P. CLOUDY, 75-80F

1100 CONTINUE GEOPROBING

1245 LUNCH

1345 CONTINUE GEOPROBING

1700 AT GEOPROBE RDB-10, LITTLE RECOVERY.

1715 MATECO OFFSITE

1720 IAN OFFSITE

SUMMARY

GEOPROBES COMPLETED RDB-01, 02, 03, 04, 05, 06, 10, 11

1740 RMT OFFSITE

6/11/08 1/7

12TH ST LF

715 - RMT ONSITE

740 MATECO ONSITE

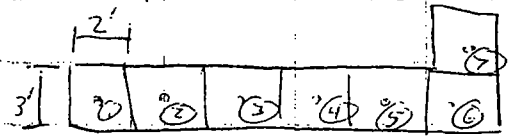
730 - IAN ONSITE

730 - DISCUSSED USING A TP AT RDB-10 W/ IAN B/C OF POOR RECOVERY. IAN CALLED J. KAISER TO DISCUSS

WEATHER - SUNNY, 70F, CALM

810 MATECO LAYING ALTERNAMATS TO GAIN ACCESS TO TP-01

850-930 EXCAVATION TP-01



↓N

→DIR. OF EXC.

* 3" TO 6" STANDING WATER

(1) 3' PAPER RESIDUALS GLEY 1 5/N
1' CLAYEY ORGANIC, 10 YR 4/4

(2) 2' Paper residuals GLEY 1 5/N
1' CLAYEY ORGANIC SOIL, 10YR 4/4

(3) SAME

(4) 0.5' Topsoil 10YR 3/2
2' Paper Residuals ~~10~~ GLEY 1 5/N
0.5 PEAT

2/7

(5) 1.0' Topsoil w/ org. 10YR 3/2
6" Paper residuals GLEY 1 5/N
1.0' PEAT

(6) 1.0' Topsoil w/ organics 10YR 3/2, WATER COMING INTO EXC. REALLY FAST

(7) 2' PEAT, SOME PAPER RESIDUALS, TOPSOIL

STOPPED EXCAVATION OF TP-01 B/C OF WATER FLOWING INTO EXC. – HARD TO SEE ANY SOIL LAYERING, PER L. HICKEN (AMT)

* BKT OF BACKHOE CLEANED TO REMOVE GROSS CONTAMINATION

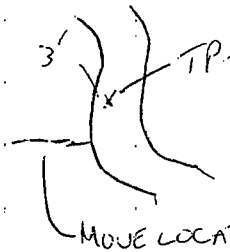
1000 MATED USING ALTERNAMATS TO GET BACKHOE OUT OF WETLAND

1145 – LUNCH
1230

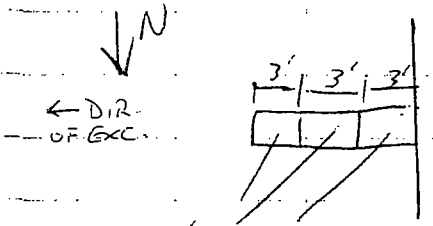
1245 – 1300 RD TP-8 (BEGAN EXCAVATION)

THE STAKED LOCATION IS APPROX. 3' INTO ASPHALT PLANT DRIVEWAY

3/7



- NO RESIDUALS VISIBLE ON SURFACE NEAR TP-8 LOCATION

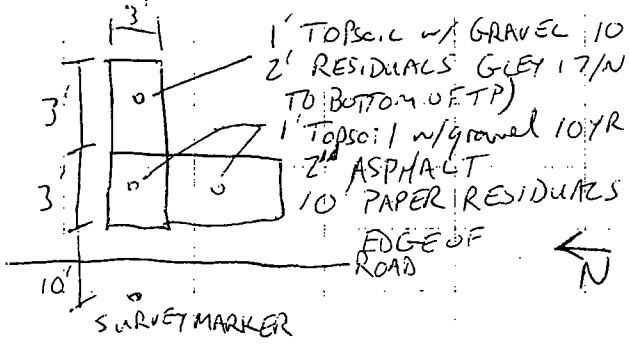


2.5' SANDY TOPSOIL, UNCOVERED UNMARKED UTILITY LINES, (1 PHONE, 1 COPPER)

- STOPPED EXCAVATION, PROPOSED TO DO HAND AUGERS AT TP-8 B/C OF UTILITIES. IAN CALLED J. KAISER TO IAN
- CALLED MISS DIG FOR 2ND UTILITY LOCATE

4/7

1300-1320 EXCAVATED TP-09



* DTW ≈ 11.0'

1320 Called RMT TO Discuss THICKNESS OF RESIDUALS AT TP-9 and TP-10 LOCATION IN WETLAND,

1400 DISCUSSED WITH IAN USING HAND AUGER BORINGS AT TP-10, AND TP-8 AND USING GEOPROBE AT TP-9. IAN CALLED J. KAISER TO DISCUSS

1430 MICHIGAN GAS ONSITE, SM+P ONSITE TO VERIFY UTILITIES AT TP-08 WERE NOT BEING USED

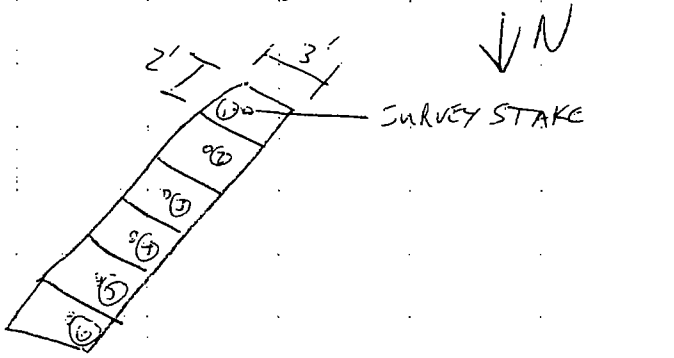
5/7

(U.S. EPA)

1520 IAN SAID MICHAEL GAVE HIS VERBAL APPROVAL TO PERFORM A TEST PIT AT RDB-10, HAND AUGERS AT TP-8, -10, AND A GEOPROBE AT TP-9.

1525-1552

RDB-10 (TEST PIT)



1. 0.5' Topsoil w/ Organics, 10YR 3/2
   5' SAND (P. GRADED) w/ BOULDERS 10YR 5/4
2. 0.5' Topsoil w/ Organics 10YR 3/2
   2' SAND (P. GRADED) w/ BOULDERS 10YR 5/4
3. SAA
4. 0.5' TOPSOIL w/ ORGANICS 10YR 3/2
   2' SAND (P. GRADED) w/ BRICKS
5. SAA
6. 0.5' Topsoil w/ ORGANICS 10YR 3/2
   2' - SAND (P. GRADED) w/ ~~SOME~~ TRACE PAPER →

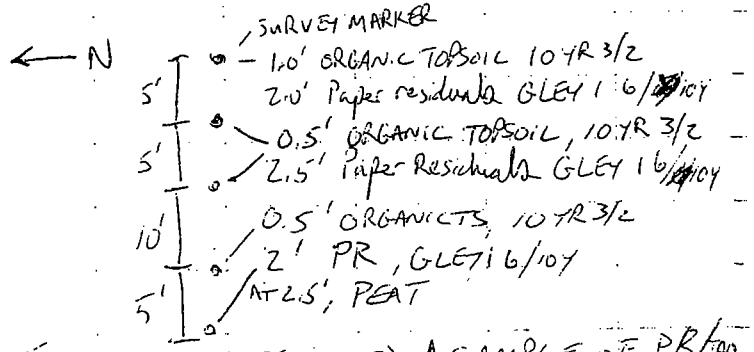
6/7

residuals and bricks

* BRICKS ARE ASSUMED TO BE CONSTRUCTION DEBRIS

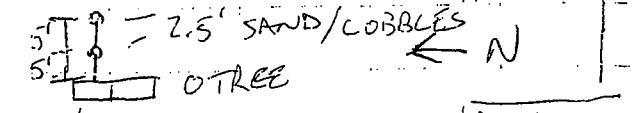
- NO GROSS CONT. ON BUCKET.

1600-1640 HAND AUGERS AT RDTP-10



~1645 S. OVERVOORDE SHOWED A SAMPLE OF PR/TAP FROM A GEOPROBE BORING AT TP-9. IAN WAS ~~FREE~~ PRESENT.

* 1530-1600 HAND AUGERS AT RDTP-08



BACKHOE TP'S • SURVEY MARKER

* NO PR ENCOUNTERED

BUT DID NOT COMMENT

7/7

1700 DISCUSSED W/ IAN THAT WE WERE GOING BACK TO USING A BACKHOE FOR TP'S 8 + 10 TOMORROW AND ALSO USING A GEOPROBE AT TP-9 TO DELINEATE EXTENT OF PR. HE CALLED S KAISER AND LEFT A MESSAGE TO DISCUSS. IAN THOUGHT THESE CHANGES SEEMED REASONABLE.

1715 IAN OFFSITE

1735 RMT OFFSITE

Weyerh. - 12th St RDI

6/9/08 5117.08

weather: cloudy, hot (80°F), wind 5-15 mph

8[30] on-site, begin set-up, fld kick-off mtg., prjt team coord.

11[50] completed RDB-09 + RDB-08, logged, PRT at RDB-08. will move back to PRT-09. Drilling new hole next to logged hole to a depth based on cores taken from original hole.

Lunch.

14[40] complete PRT gas sampling at RBB-09 and drill RDB-07, move onto RDB-07 PRT gas sampling

16[00] PRT tip was lost at bottom of RDB-07 hole. Will have new one in shop on Tues ready to pu for Wed. Rain moving in.

Need tracks to complete any more test pits. Communications re gas transmission line.

16[40] Pack up, clean up, leave site

Weyerh - 12th St RD1

6/10/08 5117.08

weather: cloudy, hot (75°), wind 5-15 mph

7:30 EW onsite, ↑ drillers on-site

8:30 onsite, aid EW w/ logging RDB locations

11:45 went to get WLs from river + swamp staff gauges. River high + swamp area is flooded to the tree line, called info into Linda/Mike, chk back w/ EW, go over logs

12:30 coord. scope for week, progress, leave site.

Weyerh - 12th St RD1

6/11/08 5117.08

weather: partly sunny, 84°, slt breeze (5-10 mph)

8[15] on-site, begin prt gas sampling. Begin at RDB-06 where left off on Monday when lost tip. Delay for tracks.

11[30] PRT sampling almost complete RDB-05, RDB-10, RDB-11, RDB-01, RDB-02; working with surveyors to locate elevations + locations of all borings/ extent of residuals in test pits/ TOC on monitoring wells

15[05] complete lunch, finish up PRT gas sampling, working w/ EW re test pits/access issues, tracking rig out.

16[00] conversation w/ asphalt plant regarding making access path thru brush on thier prop into the wetland. Given the "go-ahead" to do whatever we need to do. Dealing w/ utility locate company re: lines pulled up by Test Pit #8 and back gas transmission line.

Weyerh - 12th St LF

6/12/08 5117.08

weather: sunny, hot (86°F), slt breeze (5-10 mph)

8⁰⁰ Mateco/RMT arrive on-site, set-up in asphalt company parking lot to geoprobe area near test pit #9.

9³⁰ geoprobes 12 + 13 have extensive residuals. Continue step-out until find clean zone. Complete test pit 8 - extent of residuals very near toe of landfill - residuals dry "blown-off" kind not dense clay kind. No movement on getting transmission line staked. Eric W + Vince B talked to Curt. R.

11²⁰ geoprobe 14 had some residuals - not as extensive, geoprobe 15, 16 + 17 were "clean" of residuals, however there are areas of extensive thicknesses of excess asphalt. Asphalt comp. worker stopped by and jokingly asked the drillers if we had found any asphalt. Todd said that yes, in fact we had and the gentleman stated that this area was where they dumped their excess asphalt.

16³⁰ Pack up, leave site

RDB-04 at 15' bgs

CH_4	16.9 %
CO_2	8.2 %
O_2	0.0 %

Coordinate collection of WLs by SM.

12^{30} geoprobe 18 moved south and was clean. Geoprobe 19 was put in middle of "extrance" for a southern boundry. It had a small amt of residuals - must be near the edge of residuals. Geoprobe will continue one last boring after lunch.

13^{45} Geoprobe 20 was put in area near DB-2, gray clay like residuals were found. Northern extent seems to go towards the tree line.

Move up to landfill to start decon.

16^{30} Decon and pack up. Leave site.

↑ find missing sg + pz locations as poss.

Weyerh.

6/27/08 5117.08

weather: hot, humid, slt breeze (5-10 mph)
85°, sunny

8⁰⁰ RMT on-site

8³⁰ Ian (CH₂MHill), Mateco (Todd, Vince, Tim) arrive on-site, begin set-up on test pit 10.

9⁴⁵ started test pitting #10 @ 50' from edge of berm (west), brown clay/ mud located on top of peat (black/ brown in color), clay has streaks of gray + black - believed to be part of natural wetland, no odor. Ian is in agreement that this is probably not residuals tho difficult to tell.

10³⁰ finishing up test pit #10 on west/ northwest edge of berm, there is black asphalt in brown clay on top of peat

11⁰⁰ begin set-up/ track back to test pit # 11.

11⁴⁵ edge of residuals located at RDTP-11. @ 40-50' from toe of slope
0-6" black gritty seds, -asphalt co fines?
6"-4' gray residuals, no odor fly ash?
4' brown peat, dry

12³⁰ Coordinate collection of WLs by SM. geoprobe 18 moved south and was clean. Geoprobe 19 was put in middle of "extrance" for a southern boundry. It had a small amt of residuals - must be near the edge of residuals. Geoprobe will continue one last boring after lunch.

13⁴⁵ Geoprobe 20 was put in area near DB-2, gray clay like residuals were found. Northern extent seems to go towards the tree line. Move up to landfill to start decon.

16³⁰ Decon and pack up. Leave site.
find missing sg + pz locations as poss.

13[30] truck up to landfill for decon
decon tracks, excavator, misc equip
14[15] pack up + leave site.

SOIL BORING LOG

RMT

BORING NO. RDB-01

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351084.82 E: 12771667.6	732.4	20.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - E. Watruba Driller - Todd & Steve	6/10/08	6/10/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 GP	60		2	TOPSOIL - with organics, very dark grayish brown (10YR 3/2), no odor, loose.	SP									
				POORLY GRADED SAND - yellowish brown (10YR 5/4), no odor, moist, loose.	SM									
				SILTY SAND - black (10YR 2/1), no odor, dry, loose.	SP									no recovery 3-5' bgs
			4	POORLY GRADED SAND - trace gravel, dark yellowish brown (10YR 4/4), no odor.										
2 GP	80		6	...trace gravel and cobbles	SP									
			8											
3 GP	90		10	...dark grayish brown (10YR 4/3), moist, loose	SP									
			12	WELL GRADED SAND - yellowish brown (10YR 5/6), no odor, loose.	SW									
			14	...little gravel, yellowish brown (10YR 5/4), moist	SW									
4 GP	90		16	SILTY SAND - trace gravel, brown (10YR 4/3), no odor, moist, loose.	SM									PRT gas sample at 15': CH4=0.0, CO2=5.1, O2=13.8
			18	POORLY GRADED SAND - yellowish brown (10YR 5/4), no odor, loose, increasing gravel content at 19' bgs.	SP									
			20	End of Geoprobe at 20 feet.										

Checked By:	Date:	Approved By:	Date:	Firm: RMT Inc. 744 Heartland Trail Madison, WI 53717	800.283.3443 Fax 608.831.3334

WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/27/08

SOIL BORING LOG

RMT

BORING NO. RDB-02

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351119.42 E: 12771666.41	732.7	25.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - E. Watruba Driller - Todd & Steve	6/10/08	6/10/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 GP	40		0	TOPSOIL - with organics, very dark grayish brown (10YR 3/2), no odor, loose.	SP									
				POORLY GRADED SAND - yellowish brown (10YR 5/4), no odor, moist, loose.	SM									
			2	SILTY SAND (FLY ASH) - fine grained sand, black (10YR 2/1), no odor, dry, loose.	SP									no recovery 3-5' bgs
			4	POORLY GRADED SAND - trace gravel, yellowish brown (10YR 4/4), no odor, loose.										
2 GP	67			...trace cobbles	SP									
			6											
			8											
3 GP	100		10	...few gravel	SP									
			12											
				PAPER RESIDUALS - moderately plastic, gray (GLEY1 5/N), slight landfill gas odor, moist, dense.										
			14	SILTY SAND - well graded sand, yellowish brown (10YR 5/6), no odor, loose.	SM									
4 GP	92			POORLY GRADED SAND - yellowish brown (10YR 5/4), no odor, moist, loose, interbedded with fly ash laminae.	SP									PRT gas sample at 15': CH4=0.0, CO2=9.9, O2=7.8
			16	SILTY SAND (FLY ASH) - fine grained sand, black (10YR 2/1), no odor, dry, loose.	SM									
				WELL GRADED SAND - trace gravel, brownish yellow (10YR 6/6), loose.	SW									
			18	GRAVELLY POORLY GRADED SAND - yellowish brown (10YR 5/4), no odor, loose.	SP									
			20	...	SP									

Checked By:	Date:	Approved By:	Date:	Firm: RMT Inc. 744 Heartland Trail Madison, WI 53717	800.283.3443 Fax 608.831.3334

WIND GEOTECH LOG 05117.08.GPJ RMT_CORP WINDFARM.GDT 5117.08 6/27/08

RMT

SOIL BORING LOG

BORING NO. RDB-02

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
5 GP	60		22		SP									
			24	End of Geoprobe at 25 feet.										
			26											
			28											
			30											
			32											
			34											
			36											
			38											
			40											
			42											
			44											

WIND GEOTECH LOG 05117.08.GPJ RMT_CORP WINDFARM.GDT 5117.08 6/27/08

SOIL BORING LOG

RMT

BORING NO. RDB-03

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351146.43 E: 12771660.63	732.5	30.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - E. Watruba Driller - Todd & Steve	6/10/08	6/10/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 GP	40		0	TOPSOIL - with organics, very dark grayish brown (10YR 3/2), no odor, loose.	SP									
			2	POORLY GRADED SAND - yellowish brown (10YR 5/4), no odor, moist, loose.	SM									no recovery 2-5' bgs
			4	SILTY SAND (FLY ASH) - fine grained sand, black (10YR 2/1), no odor, dry, loose.										
2 GP	60		6	GRAVELLY POORLY GRADED SAND - coarse grained sand, yellowish brown (10YR 5/4), no odor.	SP									
			8											
3 GP	90		10	...trace cobbles, dark yellowish brown (10YR 4/4)	SP									
			12											
			14	...										
4 GP	80		16		SP									
			18	PAPER RESIDUALS - moderately plastic, light to dark gray (GLEY1 5/N), landfill gas odor, moist, dense, visible fibers.										PRT gas sample at 18': CH4=24.7, CO2=23.7, O2=0.0
					SW									
			20	WELL GRADED SAND - dark yellowish brown (10YR 4/4), landfill gas odor, moist, dense.	SP									

Checked By:	Date:	Approved By:	Date:	Firm: RMT Inc. 744 Heartland Trail Madison, WI 53717	800.283.3443 Fax 608.831.3334

WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/27/08

SOIL BORING LOG

RMT

BORING NO. RDB-03

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
5 GP	60		22	GRAVELLY POORLY GRADED SAND - coarse grained sand, yellowish brown (10YR 5/4), no odor, moist, loose.	SP									
			24											
			26											no recovery 25-28' bgs
6 GP	40		28	...grades to well graded coarse sand	SW									
			30	End of Geoprobe at 30 feet.										
			32											
			34											
			36											
			38											
			40											
			42											
			44											

WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/27/08

SOIL BORING LOG

RMT

BORING NO. RDB-04

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351183.02 E: 12771654.37	732.2	30.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - E. Watruba Driller - Todd & Steve	6/10/08	6/10/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 GP	40		0	TOPSOIL - with organics, very dark grayish brown (10YR 3/2), no odor, loose.										
			2	SANDY SILT (FLY ASH) - trace organics, fine grained sand, black (10YR 2/1), dry, loose.	ML									no recovery 2-5' bgs
			4											
2 GP	60		6											no recovery 5-7' bgs
				...	ML									
			8	GRAVELLY POORLY GRADED SAND - coarse grained sand, yellowish brown (10YR 5/4), no odor.	SP									
				PAPER RESIDUALS - trace sand, light gray, grading into coarse sand.										
3 GP	92		10	GRAVELLY POORLY GRADED SAND - coarse grained sand, yellowish brown (10YR 5/4), no odor, interbedded with black sandy silt (fly ash) layers 2-4" thick.	SP									
			12											
			14											
4 GP	80			...interbedded with gray paper residual laminae	SP									PRT gas sample at 15': CH4 = 16.9, CO2 = 8.2, O2 = 0.0
			16											
			18											
			20	PAPER RESIDUALS - white to light gray (GLEY1 5/N), slight petroleum odor, moist, soft, visible fibers.										

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WIND GEOTECH LOG 05117.08.GPJ RMT_CORP WINDFARM.GDT 5117.08 6/27/08

RMT

SOIL BORING LOG

BORING NO. RDB-04

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
			22	...moderately plastic, dense										
5 GP	80		24											
			26	POORLY GRADED SAND - with little gravel, yellowish brown (10YR 5/4), no odor, moist, loose, grades to well graded sand with less gravel at 29'.	SP									
6 GP	50		28											
			30	End of Geoprobe at 30 feet.										
			32											
			34											
			36											
			38											
			40											
			42											
			44											

WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/27/08

SOIL BORING LOG

RMT

BORING NO. RDB-05

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351079.95 E: 12771322.17	735.1	20.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - E. Watruba Driller - Todd & Steve	6/10/08	6/10/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 GP	30		2	TOPSOIL - with organics, very dark grayish brown (10YR 3/2) no odor, moist, loose.										
				PAPER RESIDUALS - trace organics, whitish gray, no odor, moist, some fiber.											no recovery 2-5' bgs
			4											
			6											no recovery 5-7' bgs
2 GP	40		8	WELL GRADED SAND - trace gravel, yellowish brown (10YR 5/4), no odor, moist.	SW									
			10	...little gravel	SW									
3 GP	100		12											
			14	GRAVELLY SILTY SAND - well graded sand, yellowish brown (10YR 5/4), no odor, interbedded with paper redisidual laminae.	SM									
				...no paper residual laminae	SM									PRT gas sample at 15': CH4=0.0, CO2=0.9, O2=19.0
4 GP	100		18	POORLY GRADED SAND - trace gravel, yellowish brown (10YR 5/4), no odor, moist, loose.	SP									
			20	End of Geoprobe at 20 feet.										

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WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/27/08

SOIL BORING LOG

RMT

BORING NO. RDB-06

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351105.5 E: 12771332.47	735.4	20.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - E. Watruba Driller - Todd & Steve	6/10/08	6/10/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
				PAPER RESIDUALS - gray, no odor, dry, loose.										
1 GP	67		2	SILTY SAND WITH GRAVEL - some paper residuals, trace cobbles, yellowish brown (10YR 5/6), no odor, dry, loose.	SM									
			4											
			6	...grades to moist										
2 GP	28		8		SM									
			10	...	SM									
				PAPER RESIDUALS - trace sand, whitish gray, no odor, moist.										
3 GP	100		12	GRAVELLY WELL GRADED SAND - coarse sand and gravel, yellowish brown (10YR 5/4).	SW									
			14											
4 GP	100		16	WELL GRADED SAND - fine to coarse grained sand, trace gravel, yellowish brown (10YR 5/4), no odor, moist, loose, interbedded with paper residuals.	SW									PRT gas sample at 15': CH4=0.0, CO2=2.0, O2=18.9
			18	...no interbedded paper residuals										
			20	End of Geoprobe at 20 feet.										

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WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/27/08

SOIL BORING LOG

RMT

BORING NO. RDB-07

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351137.62 E: 12771336.65	732.5	25.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - J. Overvoorde Driller - Todd & Steve	6/9/08	6/9/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
				TOPSOIL - with orgaics, very dark grayish brown (10YR 3/2), no odor, moist.										
					CL									
				LEAN CLAY - trace organics and gravel, very dark grayish brown (10YR 3/2), no odor, moist.	SW									
1 GP	67		2											
				WELL GRADED SAND WITH GRAVEL - medium to coarse grained sand, yellowish brown (10YR 5/4), no odor, loose.	SM									
			4	SILTY SAND (FLY ASH) - black (10YR 2/1), no odor, dry, loose.										
				...										
			6		SM									
2 GP	83		8	PAPER RESIDUALS - low plasticity, yellowish, grayish, very pale brown (10YR 8/2), no odor, dry, loose.										
			10	...low to moderate plasticity, gray (GLEY1 5/N), strong petroleum odor, moist, dense.										
3 GP	92		12											
			14											
				...										
4 GP			16											
			18											
			20	...										PRT gas sample at 20': CH4=0.9, CO2=0.7, O2=18.9

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WIND GEOTECH LOG 05117.08.GPJ RMT_CORP WINDFARM.GDT 5117.08 6/27/08

SOIL BORING LOG

RMT

BORING NO. RDB-07

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
5 GP	92		22											
			24	SANDY WELL GRADED GRAVEL - medium to coarse grained sand, grayish brown (10YR 5/2), slight petroleum odor, dry, loose.	GW									
			26	End of Boring at 25 feet.										
			28											
			30											
			32											
			34											
			36											
			38											
			40											
			42											
			44											

SOIL BORING LOG

RMT

BORING NO. RDB-08

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351172.34 E: 12771342.37	733.0	30.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - J. Overvoorde Driller - Todd & Steve	6/9/08	6/9/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
				TOPSOIL - with organics, brown										
1 GP	53		2	POORLY GRADED SAND WITH GRAVEL - medium to coarse grained sand, yellowish brown (10YR 5/4), no odor, dry, loose.	SP									
				SILTY CLAY - low plasticity, dark grayish brown (10YR 4/2), moist.	CL-ML									
			4	SANDY SILT (FLY ASH) - fine grained sand, trace organics, black (10YR 2/1), no odor, dry, loose.	ML									
2 GP	67		6	...	ML									
			8											
			10	...	ML									
3 GP	97		12	PAPER RESIDUALS - some fine sand, very pale brown (10YR 8/2), no odor, dry, loose.										
			14											
4 GP	100		16	...little gravel, trace cobbles, moderate plasticity, gray (GLEY1 5/N), strong petroleum odor, moist, dense, some paper fibers.										
			18											
			20	...										

WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/27/08

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SOIL BORING LOG

BORING NO. RDB-08

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
5 GP	100		22	SANDY WELL GRADED GRAVEL - fine to coarse grained sand, trace silt, light yellowish brown (10YR 6/4), no odor, dry, loose.	GW									
			24											
			26	...										PRT gas sample at 25': CH4=8.5, CO2=15.0, O2=0.0
6 GP			28		GW									
			30	End of Geoprobe at 30 feet.										
			32											
			34											
			36											
			38											
			40											
			42											
			44											

WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/27/08

SOIL BORING LOG

RMT

BORING NO. RDB-09

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351209.79 E: 12771349.59	732.9	35.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - J. Overvoorde Driller - Todd & Steve	6/9/08	6/9/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
				TOPSOIL - with organics, very dark grayish brown (10YR 3/2), no odor, moist, loose.										
1 GP	47		2	WELL GRADED SAND WITH GRAVEL - medium to coarse grained sand, yellowish brown (10YR 5/4), no odor, moist, loose.	SW									
			4	SILTY SAND - possible fly ash, fine grained sand, trace gravel, yellowish brown (10YR 5/4), no odor, dry, loose.	SM									
				...black (10YR 2/1), trace roots	SM									
2 GP	53		6	...	SM									
			8	...dark yellowish brown (10YR 3/4)										
3 GP	80		10	...	SM									
			12											
			14	...										
4 GP	87		16		SM									
			18	PAPER RESIDUALS - very pale brown (10YR 8/2), no odor, dry, loose.										
			20	...gray (GLEY1 5/N), strong petroleum odor, dry to moist, loose										

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WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/27/08

RMT

SOIL BORING LOG

BORING NO. RDB-09

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
5 GP	82		22											PRT gas sample at 22': CH4=14.8, CO2=27.0, O2=0.0
			24	...trace gravel, moderate plasiticty, wet										
6 GP	67		26	...dense										
			28											
7 GP	90		30	POORLY GRADED SAND WITH GRAVEL - medium to coarse grained sand with fine gravel, grayish brown (10YR 5/2), strong petroleum odor, wet, loose.	SP									
			32											
			34	SANDY WELL GRADED GRAVEL - medium to coarse grained sand, yellowish brown (10YR 5/6), strong petroleum odor, wet, loose.	GW									
			36	End of Geoprobe at 35 feet.										
			38											
			40											
			42											
			44											

WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/27/08

SOIL BORING LOG

RMT

BORING NO. RDB-10

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351040.68 E: 12771452.18	733.8	14.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - E. Watruba Driller - Todd & Steve	6/10/08	6/10/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 GP	20		0	TOPSOIL - with organics, very dark grayish brown (10YR 3/2), no odor, dense	SW									no recovery 1-5' bgs
			2	WELL GRADED SAND - dark grayish brown (10YR 3/2), no odor, moist, loose.										
			4											
2 GP	0		6											no recovery 5-10' bgs
			8											
			10											
3 GP	13		12											no recovery 10-13' bgs PRT gas sample at 10': CH4=0.0, CO2=2.1, O2=18.6
			14	POORLY GRADED SAND - yellowish brown (10YR 5/4), no odor, moist, loose.	SP									
				End of Geoprobe at 14 feet.										
			16											
			18											
			20											

WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/27/08

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SOIL BORING LOG

RMT

BORING NO. RDB-11

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351041.83 E: 12771604.46	732.9	15.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - E. Watruba Driller - Todd & Steve	6/10/08	6/10/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 GP	50		0–2	TOPSOIL - with organics, very dark grayish brown (10YR 3/2), no odor, dense.	SW									
					SM									
			2	WELL GRADED SAND - yellowish brown (10YR 5/4), no odor, moist, loose.	SW									
				SILTY SAND (FLY ASH) - trace cobbles, black (10YR 2/1), no odor, dry, loose.										no recovery 3-5' bgs
			4	PAPER RESIDUALS - moderate plasticity, light gray (GLEY1 5/N), no odor, moist, dense.										
2 GP	80			WELL GRADED SAND - trace gravel, dark yellowish brown (10YR 4/4), no odor.										
			6	...light yellowish brown (10YR 6/4), loose	SW									
			8											
				POORLY GRADED SAND - trace gravel, light yellowish brown (10YR 6/4), no odor, loose.	SP									
			10	...										PRT gas sample at 10': CH4=0.0, CO2=9.7, O2=10.0
3 GP	100				SP									
			12											
			14											
				End of Geoprobe at 15 feet.										
			16											
			18											
			20											

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WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/27/08

SOIL BORING LOG

RMT

BORING NO. RDB-12

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351204.77 E: 12771254.89	707.0	15.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - J. Overvoorde Driller - Todd & Steve	6/12/08	6/12/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
				ASPHALT										
1 GP	90		2	POORLY GRADED GRAVEL - white, dry, loose, angular.	GP									
				PAPER RESIDUALS - some gravel, moderate plasticity, gray (GLEY1 5/N), strong odor, moist, dense, interbedded with layer of black tar at 4.5' bgs.										
			4											
				...interbedded with layer of black tar at 5.5' bgs.										
2 GP	87		6											
			8											
				...no gravel, trace cobbles, high plasticity, wet.										
				PEAT - blackish brown, no odor.										
			10	WELL GRADED SAND WITH GRAVEL - medium to coarse grained sand with fine grained gravel, slight petroleum odor, wet, loose.	SW									
3 GP	80		12											
				...some silt.										
			14		SW									
				End of Geoprobe at 15 feet.										
			16											
			18											
			20											

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WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/27/08

SOIL BORING LOG

RMT

BORING NO. RDB-13

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351198.37 E: 12771237.94	707.2	15.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - J. Overvoorde Driller - Todd & Steve	6/12/08	6/12/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
			0	ASPHALT WITH AGGREGATE - black to gray										
				ASPHALT WITH SAND - black, slight odor, dry, loose to dense.										
1 GP	93		2	PAPER RESIDUALS - gray (GLEY1 5/N), moderate petroleum odor, dry.										
			4											
				...strong petroleum odor, moderate plasticity, dry to moist, dense.										
2 GP	83		6											
			8											
				PEAT - black (10YR 2/1), moist, loose, trace cattails at 9.5'.										
			10	WELL GRADED GRAVEL WITH SAND - fine to coarse grained sand, grayish brown (10YR 5/2), moderate petroleum odor, loose.	GW									
3 GP	80		12											
			14	...trace cobbles, yellowish brown (10YR 5/8).	GW									
				End of Geoprobe at 15 feet.										
			16											
			18											
			20											

WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/27/08

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SOIL BORING LOG

RMT

BORING NO. RDB-14

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351198.51 E: 12771223.94	706.4	15.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - J. Overvoorde Driller - Todd & Steve	6/12/08	6/12/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
				ASPHALT - black										
1 GP	80		2	WELL GRADED SAND WITH GRAVEL - fine to coarse grained sand with little gravel, dark grayish brown (10YR 4/2), no odor, moist, loose.	SW									
				...trace cobbles	SW									
			4	...interbedded with white paper residuals	SW									
2 GP	63		6	PAPER RESIDUALS - moderate plasticity, gray (GLEY1 5/N), strong petroleum odor, moist, dense.										
			8											
				PEAT - black (10YR 2/1), moist, loose, trace cattails.										
			10	SILTY SAND WITH GRAVEL - well graded sand, dark yellowish brown (10YR 4/4), no odor, wet, loose.	SM									
3 GP	50		12	POORLY GRADED GRAVEL WITH SAND - trace cobbles, yellowish brown (10YR 5/8), no odor, wet, loose.	GP									
			14											
				End of Geoprobe at 15 feet.										
			16											
			18											
			20											

WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/27/08

Checked By:	Date:	Approved By:	Date:	Firm: RMT Inc. 744 Heartland Trail Madison, WI 53717	800.283.3443 Fax 608.831.3334

SOIL BORING LOG

RMT

BORING NO. RDB-15

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351193.39 E: 12771199.56	706.2	15.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - J. Overvoorde Driller - Todd & Steve	6/12/08	6/12/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
			0	ASPHALT - black, moderate odor, loose to dense.										
1 GP	80		2	SILTY SAND WITH GRAVEL - brown, (10YR 4/3), no odor, dry, loose. ...fine grained sand, dark yellowish brown (10YR 4/4)	SM									
			4		SM									
			6	...	SM									
2 GP	40		8											no recovery 8-10' bgs
			10	...	SM									
3 GP	100		12	...dark grayish brown (10YR 4/2)	SM									
			14	WELL GRADED GRAVEL WITH SAND - trace cobbles, yellowish orange brown, no odor, wet, loose.	GW									
			16	WELL GRADED SAND - fine to coarse grained sand, trace gravel, yellowish brown (10 YR 5/8), no odor, wet, loose. End of Geoprobe at 15 feet.	SW									
			18											
			20											

WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/30/08

Checked By:	Date:	Approved By:	Date:	Firm: RMT Inc. 744 Heartland Trail Madison, WI 53717	800.283.3443 Fax 608.831.3334

SOIL BORING LOG

RMT

BORING NO. RDB-16

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351213.64 E: 12771195.28	706.0	15.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - J. Overvoorde Driller - Todd & Steve	6/12/08	6/12/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 GP	93		0	ASPHALT - black, moderate petroleum odor, loose to dense.										
				SILTY SAND - dark yellowish brown (10YR 4/4), no odor, dry, loose.	SM									
				ASPHALT - black, moderate petroleum odor, loose to dense.	SM									
			2	SILTY SAND - dark yellowish brown (10YR 4/4), no odor, dry, loose.										
				ASPHALT - black, moderate petroleum odor, dense.										
			4	SILTY SAND WITH GRAVEL - trace cobbels, very dark brown (10YR 2/2), no odor, moist, loose.	SM									
2 GP	67			...dark grayish brown (10YR 4/2)	SM									
			6											
			8	PEAT - black (10YR 2/1), moist, trace cattails.										
			10	SILTY SAND WITH GRAVEL - very dark grayish brown (10YR 3/2) to yellowish brown (10YR 5/4), no odor, wet, loose.	SM									
3 GP	95		12	WELL GRADED GRAVEL WITH SAND - trace cobbles, yellowish brown (10YR 5/8), no odor, wet, loose.	GW									
			14											
				End of Geoprobe at 15 feet.										
			16											
			18											
			20											

WIND GEOTECH LOG 05117.08.GPJ RMT_CORP WINDFARM.GDT 5117.08 6/27/08

Checked By:	Date:	Approved By:	Date:	Firm: RMT Inc. 744 Heartland Trail Madison, WI 53717	800.283.3443 Fax 608.831.3334

SOIL BORING LOG

BORING NO. RDB-17

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351233.99 E: 12771180.73	706.0	15.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - J. Overvoorde Driller - Todd & Steve	6/12/08	6/12/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
			0	TOPSOIL - with organics, moist.										
1 GP	77		2	WELL GRADED SAND WITH GRAVEL - fine to coarse grained sand, yellowish brown (10YR 5/4), slight petroleum odor, dry, loose.	SW									
				ASPHALT										
			4											
2 GP	67		6	SILTY SAND WITH GRAVEL - dark yellowish brown (10YR 4/4), no odor, moist.	SM									
			8	ASPHALT - interbedded with dense brownish tan clay layer 2" thick, no odor.										
				PEAT - black (10YR 2/1), moist, loose, trace cattails.										
			10	SILTY SAND WITH GRAVEL - well graded sand, dark yellowish brown (10YR 4/4), no odor, wet, loose.	SM									
3 GP	70		12											
				WELL GRADED GRAVEL WITH SAND - trace cobbles, yellowish brown (10YR 5/8), no odor, wet, loose.	GW									
			14											
				End of Geoprobe at 15 feet.										
			16											
			18											
			20											

Checked By:	Date:	Approved By:	Date:	Firm: RMT Inc. 744 Heartland Trail Madison, WI 53717	800.283.3443 Fax 608.831.3334

WIND GEOTECH LOG 05117.08.GPJ RMT_CORP WINDFARM.GDT 5117.08 6/30/08

SOIL BORING LOG

RMT

BORING NO. RDB-18

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351176.88 E: 12771208.83	706.2	15.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - J. Overvoorde Driller - Todd & Steve	6/12/08	6/12/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
				ASPHALT - black, moderate petroleum odor, loose to dense.										
1 GP	80		2	SILTY SAND WITH GRAVEL - dark grayish brown (10YR 4/2), no odor, dry, loose.	SM									
			4	...dark yellowish brown (10YR 4/4)	SM									
2 GP	63		6	...trace cobbles, dark grayish brown (10YR 4/2), moist	SM									
			8	...yellowish brown (10YR 5/6)	SM									
			10	...dark yellowish brown (10YR 4/4), wet	SM									
3 GP	73		12	WELL GRADED GRAVEL WITH SAND - trace cobbles, yellowish brown (10YR 5/8), no odor, loose.	GW									
			14											
				End of Geoprobe at 15 feet.										
			16											
			18											
			20											

WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/27/08

Checked By:	Date:	Approved By:	Date:	Firm: RMT Inc. 744 Heartland Trail Madison, WI 53717	800.283.3443 Fax 608.831.3334

SOIL BORING LOG

RMT

BORING NO. RDB-19

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351181.33 E: 12771231.59	706.9	15.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - J. Overvoorde Driller - Todd & Steve	6/12/08	6/12/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
			0	PAPER RESIDUALS - very pale brown (10YR 8/2), dry, loose.										
				...gray (GLEY1 5/N), dry, dense	SM									
1 GP	68		2	SILTY SAND WITH GRAVEL - fine to coarse grained sand, brown (10YR 4/3).	SM									
				...dark yellowish brown (10YR 4/4)										
			4	POORLY GRADED GRAVEL WITH SAND - yellowish brown (10YR 5/8), no odor, wet, loose.	GP									
				ASPHALT - black, slight petroleum odor, loose to dense.										
			6											
2 GP	83		8	SILTY SAND - trace fine grained gravel, very dark grayish brown (10YR 3/2), no odor, loose.	SM									
				PAPER RESIDUALS - very pale brown (10YR 8/2), dry, loose.										
				...gray (GLEY1 5/N), medium to dense	SM									
			10	SILTY SAND WITH GRAVEL - very dark grayish brown (10YR 3/2), no odor, moist, loose to dense.	SM									
				...dark grayish brown (10YR 4/2), wet, loose										
3 GP	53		12											
				WELL GRADED GRAVEL WITH SAND - trace cobbles, yellowish brown (10YR 5/8), wet, loose.	GW									
			14											
				End of Geoprobe at 15 feet.										
			16											
			18											
			20											

WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/27/08

Checked By:	Date:	Approved By:	Date:	Firm: RMT Inc. 744 Heartland Trail Madison, WI 53717	800.283.3443 Fax 608.831.3334

SOIL BORING LOG

RMT

BORING NO. RDB-20

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Weyerhaeuser - 12th Street Landfill - Otsego Township, Michigan	N: 351231.57 E: 12771224.6	706.7	15.0	2

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs):
Mateco	Direct Push; Geoprobe	Logged By - J. Overvoorde Driller - Todd & Steve	6/12/08	6/12/08	---

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	DENSITY (PCF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 GP	97		2	ASPHALT - black, moderate petroleum odor, dense.										
			4											
				SILTY SAND WITH GRAVEL - trace cobbles, dark grayish brown (10YR 4/2), no odor, loose.	SM									
2 GP	87		6	SANDY SILT WITH GRAVEL - trace cobbles, dark grayish brown (10YR 4/2), no odor, moist.	ML									
			8	PAPER RESIDUALS - low plasticity, gray (GLEY1 5/N), strong petroleum odor, moist.										
				PEAT - black (10YR 2/1), moist, loose, trace cattails.										
3 GP	75		10	WELL GRADED SAND - fine to medium grained, grayish brown (10YR 5/2), slight petroleum odor, wet, loose.	SW									
			12											
			14											
				End of Geoprobe at 15 feet.										
			16											
			18											
			20											

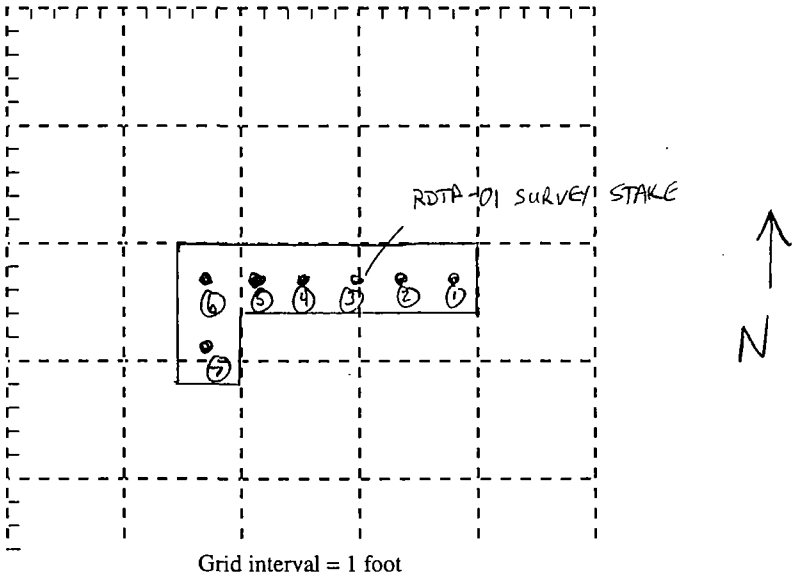
Checked By:	Date:	Approved By:	Date:	Firm: RMT Inc. 744 Heartland Trail Madison, WI 53717	800.283.3443 Fax 608.831.3334

WIND GEOTECH LOG 05117.08.GPJ RMT_CORP_WINDFARM.GDT 5117.08 6/27/08

TEST PIT LOG

PROJECT:	12th Street Landfill	**PROJECT NO.:**	00-05117.08
LOCATION:	Wetland (northwest of landfill)	**CONTRACTOR:**	Mateco
TEST PIT:	RDTP-01	**DATE:**	June 11, 2008
TIME BEGIN:	8:50	**TIME END:**	9:30

TEST PIT DIAGRAM – PLAN VIEW



Grid interval = 1 foot

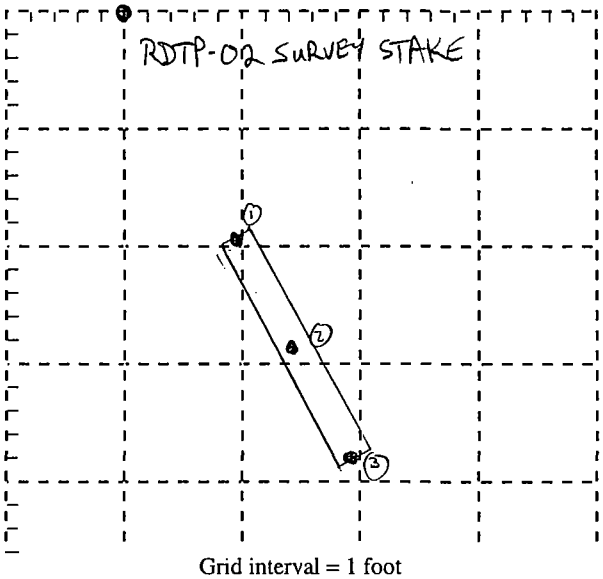
TEST PIT DIMENSIONS: L = 15', W = 3'

POINT	TEST PIT DEPTH (feet below land surface) FROM	TO	TEST PIT DESCRIPTION
1	0.0	3.0	Paper residuals, gray GLEY 1 5/N, saturated, 3" to 6" standing water
	3.0	4.0	Clayey organic soil, dark yellowish brown 10 YR 4/4
2	0.0	2.0	Paper residuals, gray GLEY 1 5/N, saturated, 6" standing water
	2.0	3.0	Clayey organic soil, dark yellowish brown 10 YR 4/4
3	0.0	2.0	Paper residuals, gray GLEY 1 5/N, saturated, 6" standing water
	2.0	3.0	Clayey organic soil, dark yellowish brown 10 YR 4/4
4	0.0	0.5	Topsoil with organics, very dark grayish brown 10 YR 3/2, 6" standing water
	0.5	2.5	Paper residuals, gray GLEY 1 5/N
	2.5	3.0	Organic soil (peat)
5	0.0	1.0	Topsoil with organics, very dark grayish brown 10 YR 3/2, 6" standing water
	1.0	1.5	Paper residuals, gray GLEY 1 5/N
	1.5	2.5	Organic soil (peat)
6	0.0	1.0	Topsoil with organics, very dark grayish brown 10 YR 3/2, 6" standing water, water coming into excavation really fast, difficult to see anything below 1.0'
7	0.0	2.0	Organic soil (peat) mixed with topsoil, some paper residuals layered within peat/topsoil

TEST PIT LOG

PROJECT:	12th Street Landfill	**PROJECT NO.:**	00-05117.08
LOCATION:	Wetland (north of landfill)	**CONTRACTOR:**	Mateco
TEST PIT:	RDTP-02	**DATE:**	June 9, 2008
TIME BEGIN:	14:35	**TIME END:**	15:00

TEST PIT DIAGRAM – PLAN VIEW



Grid interval = 1 foot

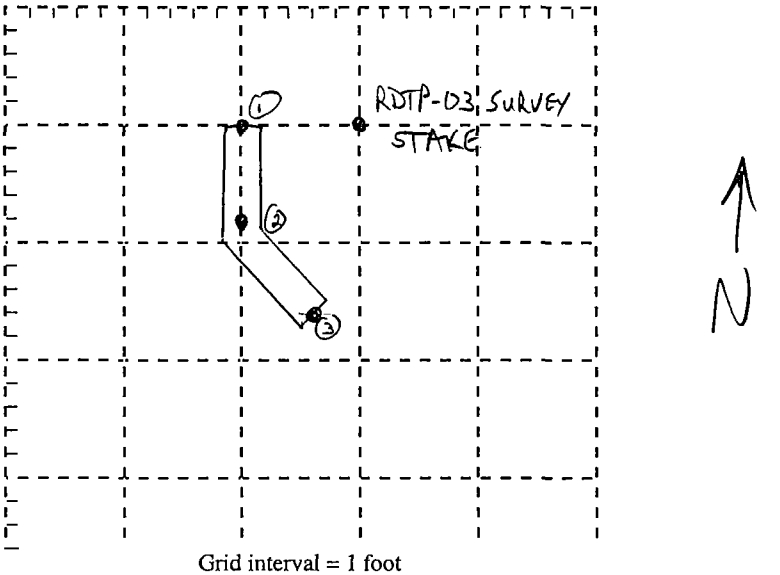
TEST PIT DIMENSIONS: L = 10', W = 1.5'

POINT	TEST PIT DEPTH (feet below land surface) FROM	TO	TEST PIT DESCRIPTION
1	0.0	2.0	Topsoil with organics (saturated), dark gray 10 YR 3/1, 2" ponded water
2	0.0	0.66	Paper residuals, light gray GLEY 1 7/N (moist)
	0.66	2.0	Topsoil with organics, very dark gray 10 YR 3/1, saturated, depth to water = 12"
3	0.0	0.66	Paper residuals, light gray GLEY 1 7/N, moist
	0.66	2.33	Topsoil with organics, dark gray 10 YR 3/1, saturated, depth to water = 12"

TEST PIT LOG

PROJECT:	12th Street Landfill	**PROJECT NO.:**	00-05117.08
LOCATION:	Wetland (northeast corner of landfill)	**CONTRACTOR:**	Mateco
TEST PIT:	RDTP-03	**DATE:**	June 9, 2008
TIME BEGIN:	13:40	**TIME END:**	14:10

TEST PIT DIAGRAM – PLAN VIEW



Grid interval = 1 foot

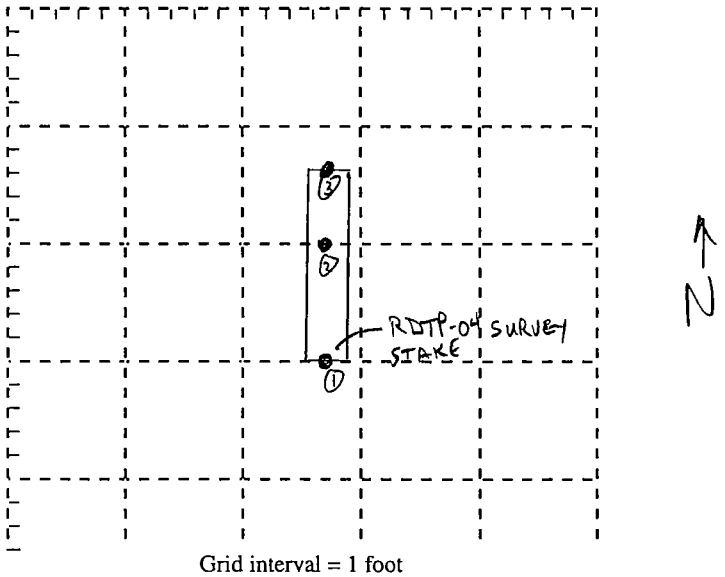
TEST PIT DIMENSIONS: L = 9', W = 1.5'

POINT	TEST PIT DEPTH (feet below land surface) FROM	TO	TEST PIT DESCRIPTION
1	0.0	1.5	Topsoil with organics, grayish brown 10 YR 3/2, depth to water = 1.5'
2	0.0	1.0	Topsoil with organics, grayish brown 10 YR 3/2, depth to water = 1.5'
	1.0	2.5	Sand (silty, poorly graded), yellowish brown 10 YR 5/6
	2.5	4.5	Clayey sand, brown 10 YR 5/3
3	0.0	0.66	Paper residuals, light gray GLEY 1 7/N, depth to water = 1.5'
	0.66	2.16	Sand, yellowish brown 10 YR 5/6

TEST PIT LOG

PROJECT:	12th Street Landfill	**PROJECT NO.:**	00-05117.08
LOCATION:	MDNR Property	**CONTRACTOR:**	Mateco
TEST PIT:	RDTP-04	**DATE:**	June 9, 2008
TIME BEGIN:	10:40	**TIME END:**	11:00

TEST PIT DIAGRAM – PLAN VIEW



Grid interval = 1 foot

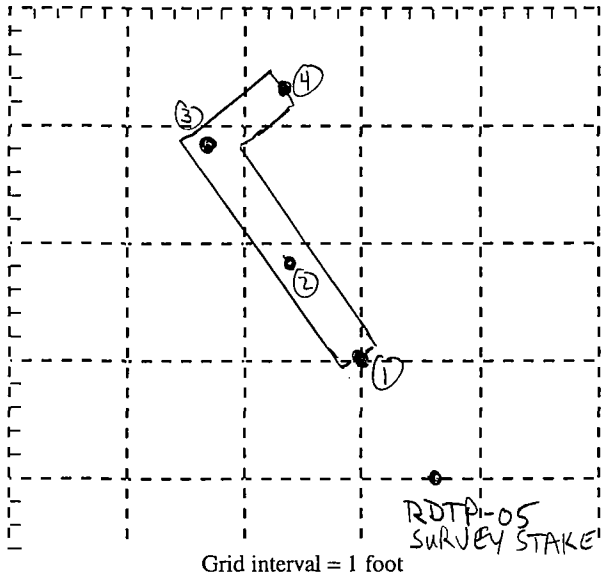
TEST PIT DIMENSIONS: L = 8', W = 1.5'

POINT	TEST PIT DEPTH (feet below land surface) FROM	TO	TEST PIT DESCRIPTION
1	0.0	1.0	Topsoil with organics, very dark grayish brown 10 YR 3/2
	1.0	2.0	Sand (poorly graded), yellowish brown 10 YR 5/6
2	0.0	0.5	Paper residuals, light gray GLEY 1 7/N
	0.5	1.5	Sand (poorly graded), yellowish brown 10 YR 5/6, some topsoil layering
3	0.0	0.5	Paper residuals, light gray GLEY 1 7/N
	0.5	1.5	Sand (poorly graded), yellowish brown 10 YR 5/6, some topsoil layering

TEST PIT LOG

PROJECT:	12th Street Landfill	**PROJECT NO.:**	00-05117.08
LOCATION:	MDNR Property	**CONTRACTOR:**	Mateco
TEST PIT:	RDTP-05	**DATE:**	June 9, 2008
TIME BEGIN:	11:05	**TIME END:**	11:20

TEST PIT DIAGRAM – PLAN VIEW



Grid interval = 1 foot

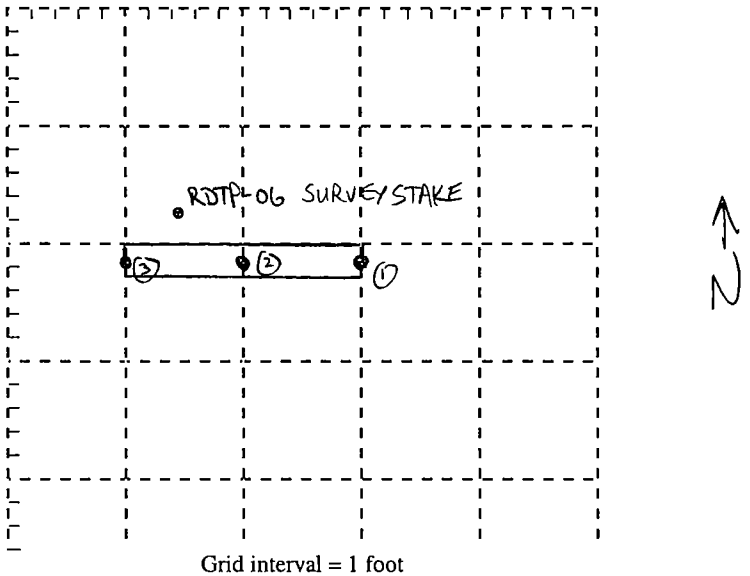
TEST PIT DIMENSIONS: L = 15', W = 1.5'

POINT	TEST PIT DEPTH (feet below land surface) FROM	TO	TEST PIT DESCRIPTION
1	0.0	1.0	Topsoil, very dark grayish brown 10 YR 3/2
	1.0	3.0	Silty sand (poorly graded), yellowish brown 10 YR 5/6
2	0.0	1.0	Topsoil, very dark grayish brown 10 YR 3/2
	1.0	3.0	Silty sand (poorly graded), yellowish brown 10 YR 5/6
3	0.0	1.0	Topsoil, very dark grayish brown 10 YR 3/2
	1.0	3.0	Silty sand (poorly graded), yellowish brown 10 YR 5/6
4	0.0	0.66	Paper residuals, light gray GLEY 1 7/N
	0.66	2.66	Silty sand (poorly graded), yellowish brown 10 YR 5/6

TEST PIT LOG

PROJECT:	12th Street Landfill	**PROJECT NO.:**	00-05117.08
LOCATION:	MDNR Property	**CONTRACTOR:**	Mateco
TEST PIT:	RDTP-06	**DATE:**	June 9, 2008
TIME BEGIN:	11:35	**TIME END:**	11:55

TEST PIT DIAGRAM – PLAN VIEW



Grid interval = 1 foot

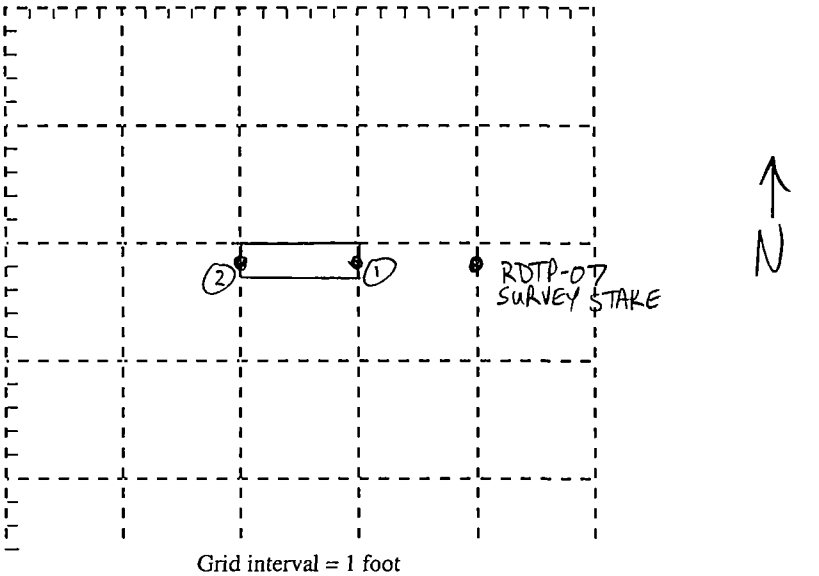
TEST PIT DIMENSIONS: L = 10', W = 1.5'

POINT	TEST PIT DEPTH (feet below land surface) FROM	TO	TEST PIT DESCRIPTION
1	0	1.0	Topsoil, very dark grayish brown 10 YR 3/2
	1.0	2.5	Silty sand (poorly graded), yellowish brown 10 YR 5/6
2	0	2.0	Topsoil, very dark grayish brown 10 YR 3/2
	2.0	4.0	Silty sand (poorly graded), yellowish brown 10 YR 5/6
3	0	0.66	Paper residuals, light gray GLEY 1 7/N
	0.66	3.66	Silty sand (poorly graded), yellowish brown 10 YR 5/6

TEST PIT LOG

PROJECT:	12th Street Landfill	**PROJECT NO.:**	00-05117.08
LOCATION:	MDNR Property	**CONTRACTOR:**	Mateco
TEST PIT:	RDTP-07	**DATE:**	June 9, 2008
TIME BEGIN:	12:05	**TIME END:**	12:15

TEST PIT DIAGRAM – PLAN VIEW



Grid interval = 1 foot

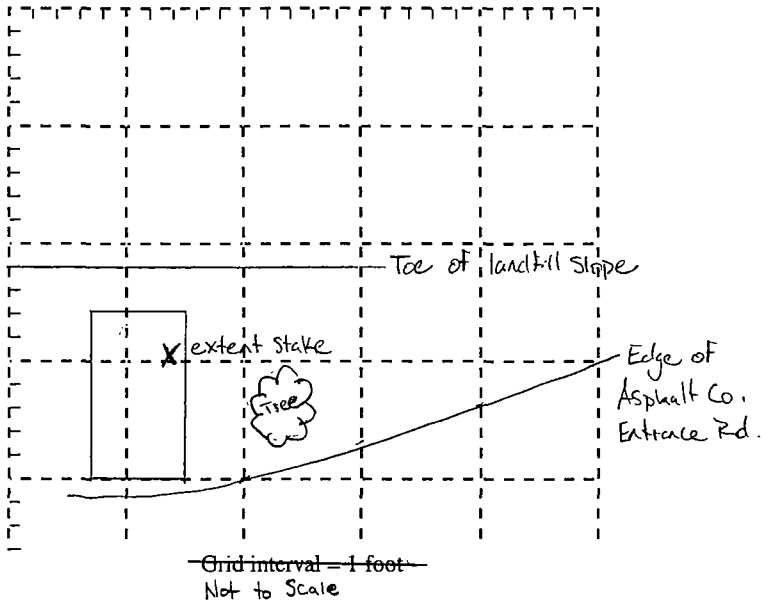
TEST PIT DIMENSIONS: L = 5', W = 1.5'

POINT	TEST PIT DEPTH (feet below land surface) FROM	TO	TEST PIT DESCRIPTION
1	0.0	0.5	Topsoil, dark grayish brown 10 YR 3/2
	0.5	2.5	Sand (poorly graded), yellowish brown 10 YR 5/6
2	0.0	0.66	Paper residuals, light gray GLEY 1 7/N
	0.66	2.66	Sand (poorly graded), yellowish brown 10 YR 5/6

TEST PIT LOG

PROJECT:	12th Street Landfill	**PROJECT NO.:**	00-05117.08
LOCATION:	Asphalt Plant Property	**CONTRACTOR:**	Mateco
TEST PIT:	RDTP-08	**DATE:**	June 12, 2008
TIME BEGIN:	9:10	**TIME END:**	9:30

TEST PIT DIAGRAM – PLAN VIEW



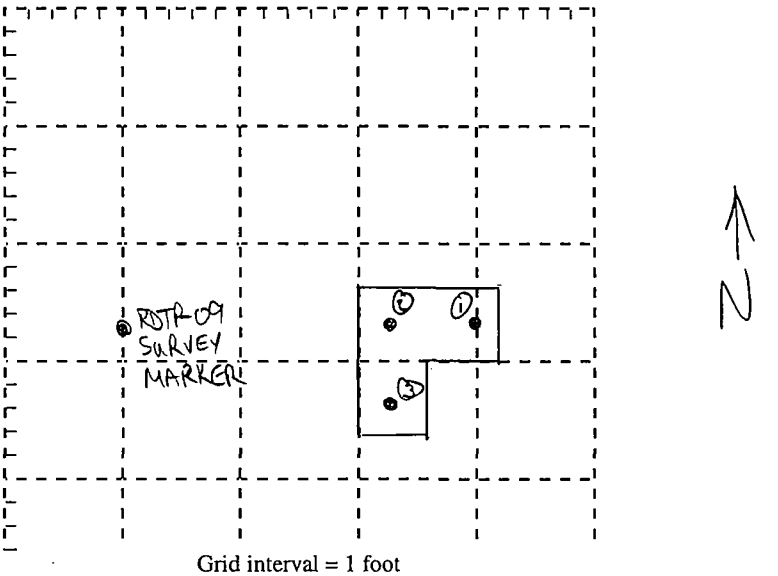
TEST PIT DIMENSIONS: L = 5', W = 3'

TEST PIT DEPTH (feet below land surface) FROM	TO	TEST PIT DESCRIPTION
0.0	1.5	Dark-brown topsoil with gravel, dry, loose
1.5	2.0	Paper residuals, dry, loose, gray GLEY 1 5/N
2.0	3.0	Grayish-/Blackish-brown sand with gravel, dry, loose
		—

TEST PIT LOG

PROJECT:	12th Street Landfill	**PROJECT NO.:**	00-05117.08
LOCATION:	Asphalt Plant Property	**CONTRACTOR:**	Mateco
TEST PIT:	RDTP-09	**DATE:**	June 11, 2008
TIME BEGIN:	13:00	**TIME END:**	13:20

TEST PIT DIAGRAM – PLAN VIEW



Grid interval = 1 foot

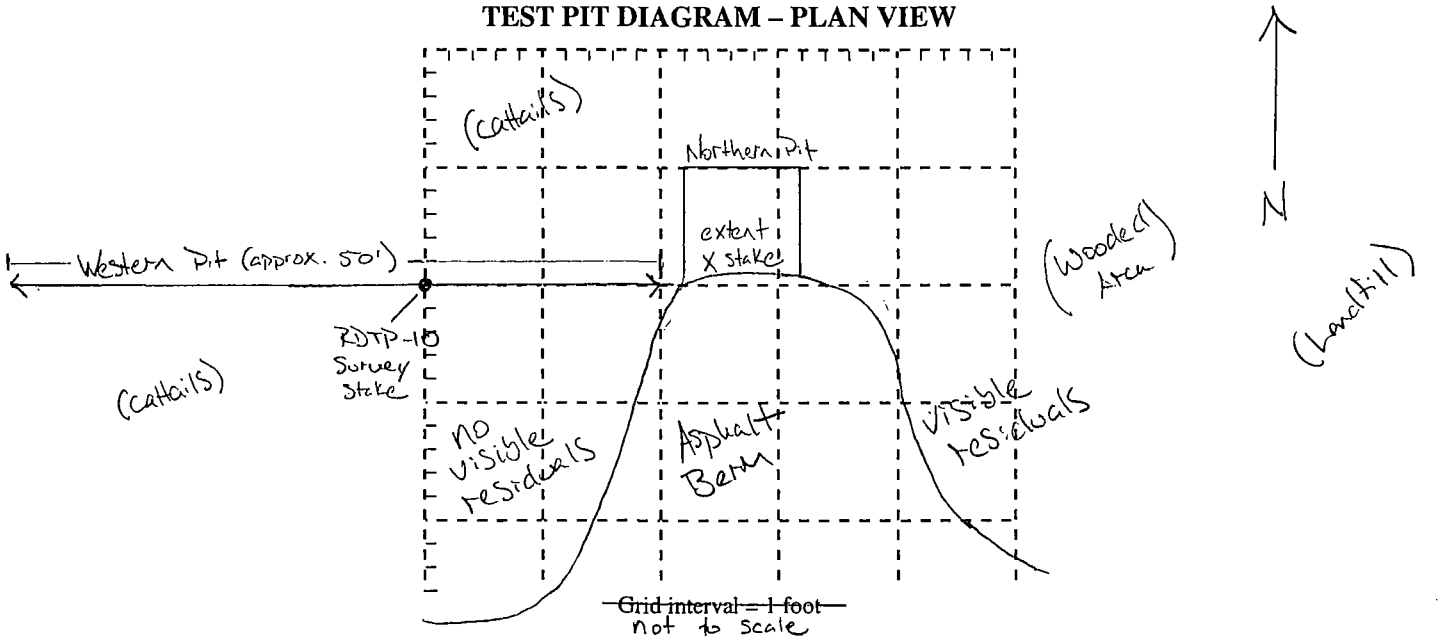
TEST PIT DIMENSIONS: L = 9', W = 3'

POINT	TEST PIT DEPTH (feet below land surface) FROM	TO	TEST PIT DESCRIPTION
1	0.0	1.0	Topsoil with gravel, very dark grayish brown 10 YR 3/2
	1.0	3.0	Paper residuals, light gray GLEY 1 7/N (extended to bottom of test pit)
2	0.0	1.0	Topsoil with gravel, very dark grayish brown 10 YR 3/2
	1.0	1.2	Asphalt
	1.2	11.2	Paper residuals, light gray GLEY 1 7/N, depth to water = ~11.0', cattails
3	0.0	1.0	Topsoil with gravel, very dark grayish brown 10 YR 3/2
	1.0	1.2	Asphalt
	1.2	11.2	Paper residuals, light gray GLEY 1 7/N, depth to water = ~11.0', cattails

TEST PIT LOG

PROJECT:	12th Street Landfill	**PROJECT NO.:**	00-05117.08
LOCATION:	Asphalt Plant Property	**CONTRACTOR:**	Mateco
TEST PIT:	RDTP-10	**DATE:**	June 27, 2008
TIME BEGIN:	9:30	**TIME END:**	12:30

TEST PIT DIAGRAM – PLAN VIEW



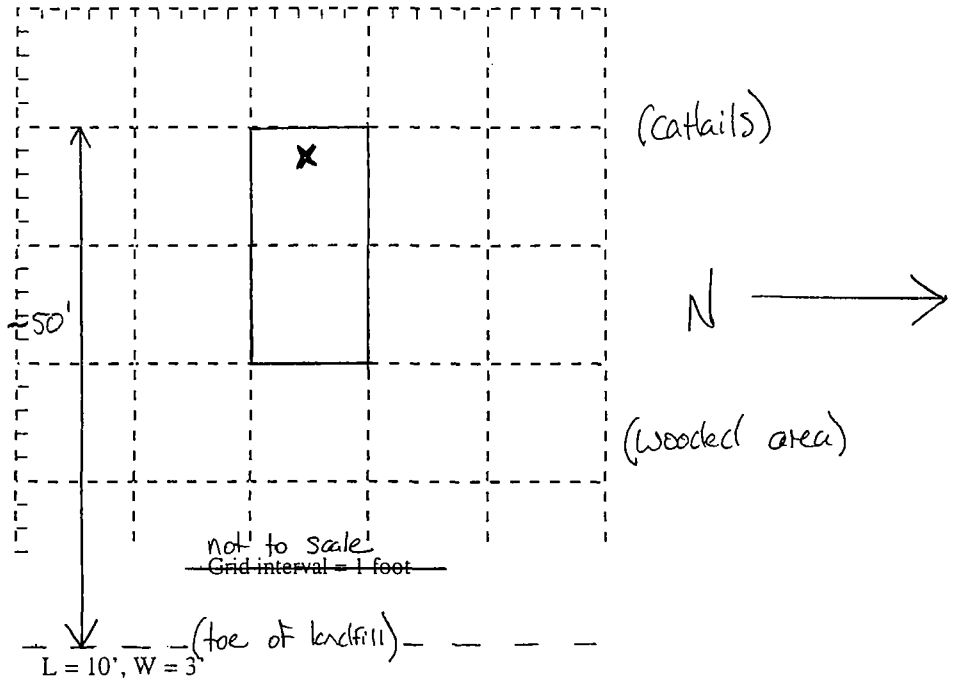
TEST PIT DIMENSIONS: Western Pit: L = 50', W = 3'
Northern Pit: L = 6', W = 3'

	TEST PIT DEPTH (feet below land surface) FROM	TO	TEST PIT DESCRIPTION
Northern Pit	0	0.5	Cattails, organic topsoil, dark brown
	0.5	4.0	Gray residuals, moderate density, GLEY 1 5/N, thick, no odor
	4.0		Medium brown peat, dry, compact
Western Pit	0	0.5	Dark-brown organic topsoil, cattails
	0.5	3.5	Brown mottled clay, no odor, gray and black streaks, seem to be associated with decaying organic matter
	3.5		Peat
			Note: Significant standing water over entire test pitting area

TEST PIT LOG

PROJECT:	12th Street Landfill	**PROJECT NO.:**	00-05117.08
LOCATION:	Asphalt Plant Property	**CONTRACTOR:**	Mateco
TEST PIT:	RDTP-11	**DATE:**	June 27, 2008
TIME BEGIN:	11:00	**TIME END:**	11:45

TEST PIT DIAGRAM – PLAN VIEW



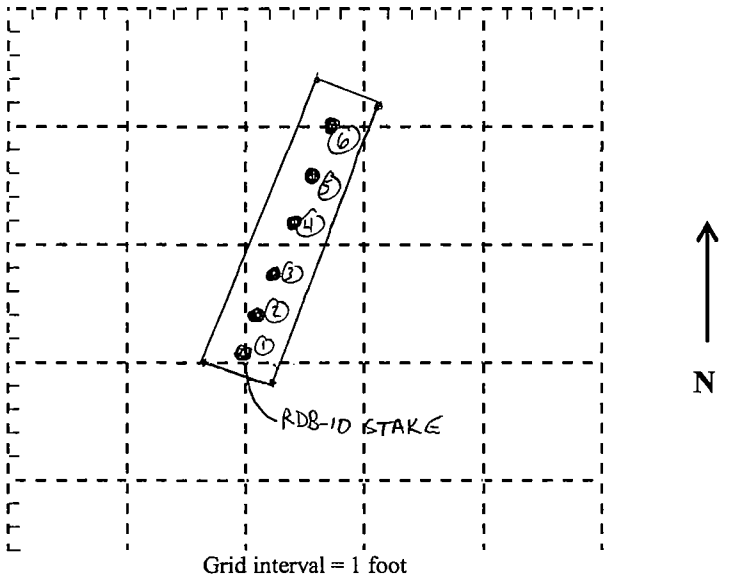
TEST PIT DIMENSIONS:

TEST PIT DEPTH (feet below land surface) FROM	TO	TEST PIT DESCRIPTION
0	0.5	Black, gritty sediment (fly ash or asphalt fines?)
0.5	4.0	Gray GLEY 1 5/N, residuals, no odor, moist in bottom
4.0		Moderate-/Dark-brown peat, dry, compact
		Note: No standing water in area; much easier test pitting than with RDTP-10

TEST PIT LOG

PROJECT:	12th Street Landfill	**PROJECT NO.:**	00-05117.08
LOCATION:	Southern Landfill Property Line (southwest corner)	**CONTRACTOR:**	Mateco
TEST PIT:	RDTP-12	**DATE:**	June 11, 2008
TIME BEGIN:	15:25	**TIME END:**	15:50

TEST PIT DIAGRAM – PLAN VIEW



Grid interval = 1 foot

TEST PIT DIMENSIONS: L = 12', W = 3'

POINT	TEST PIT DEPTH (feet below land surface) FROM	TO	TEST PIT DESCRIPTION
1	0.0	0.5	Topsoil with organics, very dark grayish brown 10 YR 3/2
	0.5	5.5	Poorly graded sand with boulders, yellowish brown 10 YR 5/4
2	0.0	0.5	Topsoil with organics, very dark grayish brown 10 YR 3/2
	0.5	2.5	Poorly graded sand with boulders, yellowish brown 10 YR 5/4
3	0.0	0.5	Topsoil with organics, very dark grayish brown 10 YR 3/2
	0.5	2.5	Poorly graded sand with boulders, yellowish brown 10 YR 5/4
4	0.0	0.5	Topsoil with organics, very dark grayish brown 10 YR 3/2
	0.5	2.5	Poorly graded sand with bricks
5	0.0	0.5	Topsoil with organics, very dark grayish brown 10 YR 3/2
	0.5	2.5	Poorly graded sand with bricks
6	0.0	0.5	Topsoil with organics, very dark grayish brown 10 YR 3/2
	0.5	2.5	Poorly graded sand with some paper residuals, bricks

APPENDIX B

Appendix B
Photographs

RMT

Photographic Log

Client Name	Site Location	Project No.
Weyerhaeuser	12th Street Landfill	00-05117.08

Photo No.	Date
1	6/11/08

Description

Excavating test pit RDTP-01 within the wetland. Notice the water in the excavation (looking southwest).

Photo No.	Date
2	6/9/08

Description

Excavating test pit RDTP-02 (looking south).

RMT

Photographic Log

Client Name	Site Location	Project No.
Weyerhaeuser	12th Street Landfill	00-05117.08

Photo No.	Date
3	6/11/08

Description

Excavation of test pit RDTP-09.

Photo No.	Date
4	6/10/08

Description

Advancing a Geoprobe® soil boring at RDB-13 (looking east).

RMT

Photographic Log

Client Name	Site Location	Project No.
Weyerhaeuser	12th Street Landfill	00-05117.08

Photo No.	Date
5	6/27/08

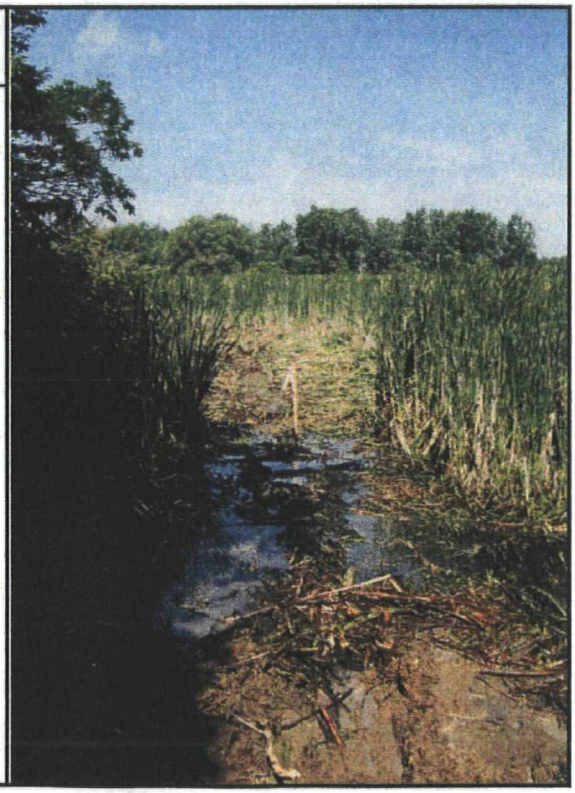
Description

Excavation of test pit RDTP-10 (looking south)

Photo No.	Date
6	6/27/08

Description

Standing water within wetland at test pit RDTP-10 (looking northwest).



RMT

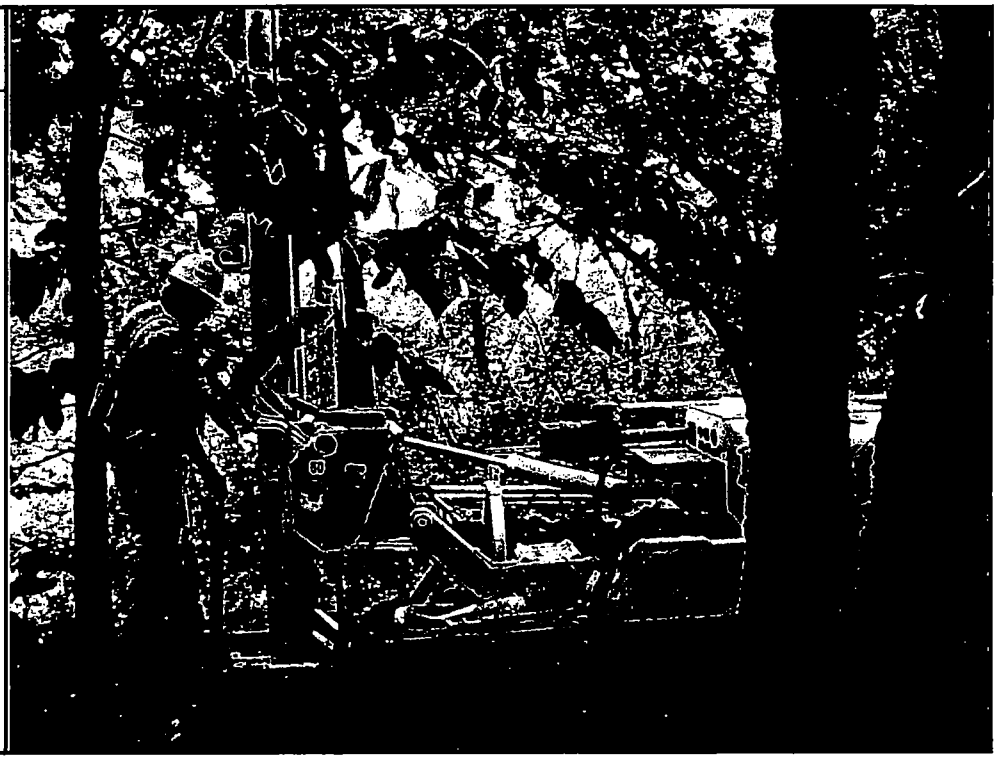
Photographic Log

Client Name	Site Location	Project No.
Weyerhaeuser	12th Street Landfill	00-05117.08

Photo No.	Date
7	6/10/08

Description

Advancing a Geoprobe® soil boring at RDB-03 (looking south).



APPENDIX C

Appendix C
Sampling Results for Water Supply Well on Asphalt Plant Property

TRACE
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phone 231.773.5998
toll-free 800.733.5998
fax 231.773.6537

Trace Analytical Laboratories, Inc.
2241 Black Creek Road
Muskegon, MI 49444-2673
info@trace-labs.com
www.trace-labs.com

July 29, 2008

Ms. Jennifer Overvoorde
RMT, Inc.
2025 E. Beltline Ave. SE Suite 402
Grand Rapids, MI 49546

Phone: (616) 975-5415
Fax: (616) 975-1098

RE: Trace ID: T08G091

Dear Ms. Overvoorde:

Enclosed are your analytical results associated with your project for 12th St. Landfill / 5117.08.

The results were obtained from MDEQ.

Thank you for working with Trace. If you have questions concerning this report, please contact me at 231.773.5998 or by email at jmink@trace-labs.com.

Sincerely,

Jon Mink
Project Manager

Enclosures

ACCREDITED IN ACCORDANCE WITH nelac

TRACE OPERATES IN COMPLIANCE WITH THE DEPARTMENT OF DEFENSE
QUALITY SYSTEMS MANUAL FOR ENVIRONMENTAL LABORATORIES

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DEQ

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
DRINKING WATER LABORATORY
USEPA Region V Drinking Water Cert. No. MI00003
P.O. Box 30270
Lansing, MI 48909
TEL: (517) 335-8184
FAX: (517) 335-8562

Sample Number
LC26884

Official Laboratory Report

Report To: TRACE ANALYTICAL LABS
2241 BLACK CREEK RD
MUSKEGON MI 49444

System Name/Owner:		WSSN/Pool ID:		
Collection Address:	12TH ST LANDFILL,	Source:	Other	
Collected By:	SCOT MIDDLEBROOK	Site Code:	ID T086091	
Township/Well#/Section:	//	Collector:	Other	
County:	Unknown	Date Collected:	07/08/2008	09:01
Sample Point:	RW-1	Date Received:	07/11/2008	12:15
Water System:	Other	Purpose:	Other	

Sample Comment LC26884 **Sample was not submitted in a DEQ Drinking Water Laboratory sampling unit. Quality control check for that lot of sampling units was not performed by the DEQ laboratory.**

TESTING INFORMATION			REGULATORY INFORMATION			
Analyte Name	Result (mg/L)	Date Tested	RL (mg/L)	MCL/AL (mg/L)	Method	CAS #
Aromatic Compounds by GC/MS						
1 Methylnaphthalene	Not Detected	07/22/2008	0.001		EPA 525.2	90-12-0
2 Chloronaphthalene	Not Detected	07/22/2008	0.001		EPA 525.2	91-58-7
2 Methylnaphthalene	Not Detected	07/22/2008	0.001		EPA 525.2	91-57-6
2,4 Dinitrotoluene	Not Detected	07/22/2008	0.001		EPA 525.2	121-14-2
2,6 Dinitrotoluene	Not Detected	07/22/2008	0.001		EPA 525.2	606-20-2
Acenaphthene	Not Detected	07/22/2008	0.001		EPA 525.2	83-32-9
Acenaphthylene	Not Detected	07/22/2008	0.001		EPA 525.2	208-96-8
Anthracene	Not Detected	07/22/2008	0.001		EPA 525.2	120-12-7
Benzo[a]anthracene	Not Detected	07/22/2008	0.001		EPA 525.2	56-55-3
Benzo[a]pyrene	Not Detected	07/22/2008	0.00006	0.0002	EPA 525.2	50-32-8
Benzo[b]fluoranthene	Not Detected	07/22/2008	0.001		EPA 525.2	205-99-2
Benzo[g,h,i]perylene	Not Detected	07/22/2008	0.001		EPA 525.2	191-24-2
Benzo[k]fluoranthene	Not Detected	07/22/2008	0.001		EPA 525.2	207-08-9
Chrysene	Not Detected	07/22/2008	0.001		EPA 525.2	218-01-9
Di(2-ethylhexyl)adipate	Not Detected	07/22/2008	0.0006	0.4	EPA 525.2	103-23-1
Di(2-ethylhexyl)phthalate	Not Detected	07/22/2008	0.0006	0.006	EPA 525.2	117-81-7
Dibenz[a,h]anthracene	Not Detected	07/22/2008	0.001		EPA 525.2	53-70-3
Fluoranthene	Not Detected	07/22/2008	0.001		EPA 525.2	206-44-0
Fluorene	Not Detected	07/22/2008	0.001		EPA 525.2	86-73-7
Indeno(1,2,3,c,d)pyrene	Not Detected	07/22/2008	0.001		EPA 525.2	193-39-5
Phenanthrene	Not Detected	07/22/2008	0.001		EPA 525.2	85-01-8
Pyrene	Not Detected	07/22/2008	0.001		EPA 525.2	129-00-0

CAS# : Chemical Abstract Service Registry Number
MCL : Maximum Contaminant Level
AL : Action Level
RL : Reporting Limit

mg/L : milligrams / Liter (ppm)
ppm : parts per million
MPN : Most Probable Number
CFU : Colony Forming Unit

Laboratory Contacts
Drinking Water Unit Mgr: Julia Pieper
Systems Mgmt. Unit Mgr: George Krisztian

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Sample Number
LC26884

TESTING INFORMATION			REGULATORY INFORMATION			
Analyte Name	Result (mg/L)	Date Tested	RL (mg/L)	MCL/AL (mg/L)	Method	CAS #

A compound tentatively identified as 2,4-di-tert-butyl-phenol was detected.

Pesticides Analysis by GC/MS						
4,4'-DDD	Not Detected	07/21/2008	0.001		EPA 525.2	72-54-8
4,4'-DDE	Not Detected	07/21/2008	0.001		EPA 525.2	72-55-9
4,4'-DDT	Not Detected	07/21/2008	0.001		EPA 525.2	50-29-3
Acetochlor	Not Detected	07/21/2008	0.001		EPA 525.2	34256-82-1
Alachlor	Not Detected	07/21/2008	0.0002	0.002	EPA 525.2	15972-60-8
Aldrin	Not Detected	07/21/2008	0.0004		EPA 525.2	309-00-2
alpha-Chlordane	Not Detected	07/21/2008	0.0002	0.002	EPA 525.2	5103-71-9
alpha-Endosulfan	Not Detected	07/21/2008	0.001		EPA 525.2	959-98-8
Ametryn	Not Detected	07/21/2008	0.001		EPA 525.2	834-12-8
Atrazine	Not Detected	07/21/2008	0.0002	0.003	EPA 525.2	1912-24-9
beta-Endosulfan	Not Detected	07/21/2008	0.001		EPA 525.2	33213-65-9
Bromacil	Not Detected	07/21/2008	0.002		EPA 525.2	314-40-9
Butachlor	Not Detected	07/21/2008	0.002		EPA 525.2	23184-66-9
Butylate	Not Detected	07/21/2008	0.002		EPA 525.2	2008-41-5
Carboxin	Not Detected	07/21/2008	0.002		EPA 525.2	5234-68-4
Chlorothalonil	Not Detected	07/21/2008	0.001		EPA 525.2	1897-45-6
Cycloate	Not Detected	07/21/2008	0.002		EPA 525.2	1134-23-2
Cyprazine	Not Detected	07/21/2008	0.001		EPA 525.2	22936-86-3
Dieldrin	Not Detected	07/21/2008	0.0005		EPA 525.2	60-57-1
Diphenamid	Not Detected	07/21/2008	0.001		EPA 525.2	957-51-7
Endrin	Not Detected	07/21/2008	0.00005	0.002	EPA 525.2	72-20-8
Endrin aldehyde	Not Detected	07/21/2008	0.002		EPA 525.2	7421-93-4
EPTC	Not Detected	07/21/2008	0.001		EPA 525.2	759-94-4
gamma-Chlordane	Not Detected	07/21/2008	0.0002	0.002	EPA 525.2	5103-74-2
Heptachlor	Not Detected	07/21/2008	0.00008	0.0004	EPA 525.2	76-44-8
Heptachlor epoxide	Not Detected	07/21/2008	0.00004	0.0002	EPA 525.2	1024-57-3
Hexachlorobenzene	Not Detected	07/21/2008	0.0001	0.001	EPA 525.2	118-74-1
Hexachlorocyclohexane (alpha-BHC)	Not Detected	07/21/2008	0.001		EPA 525.2	319-84-6
Hexachlorocyclohexane (beta-BHC)	Not Detected	07/21/2008	0.001		EPA 525.2	319-85-7
Hexachlorocyclohexane (delta-BHC)	Not Detected	07/21/2008	0.001		EPA 525.2	319-86-8
Hexachlorocyclopentadiene	Not Detected	07/21/2008	0.0002	0.05	EPA 525.2	77-47-4
Hexazinone	Not Detected	07/21/2008	0.003		EPA 525.2	51235-04-2
Lindane (gamma-BHC)	Not Detected	07/21/2008	0.00004	0.0002	EPA 525.2	58-89-9
Methoxychlor	Not Detected	07/21/2008	0.0001	0.04	EPA 525.2	72-43-5
Metolachlor	Not Detected	07/21/2008	0.001		EPA 525.2	51218-45-2
Metribuzin	Not Detected	07/21/2008	0.001		EPA 525.2	21087-64-9

CAS# : Chemical Abstract Service Registry Number
MCL : Maximum Contaminant Level
AL : Action Level
RL : Reporting Limit

mg/L : milligrams / Liter (ppm)
ppm : parts per million
MPN : Most Probable Number
CFU : Colony Forming Unit

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Systems Mgmt. Unit Mgr: George Krisztian

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FAX: (517) 335-8562

Sample Number
LC26884

TESTING INFORMATION			REGULATORY INFORMATION			
Analyte Name	Result (mg/L)	Date Tested	RL (mg/L)	MCL/AL (mg/L)	Method	CAS #
Pesticides Analysis by GC/MS						
Molinate	Not Detected	07/21/2008	0.002		EPA 525.2	2212-67-1
Octachlorocyclopentene	Not Detected	07/21/2008	0.002		EPA 525.2	706-78-5
PCB (aroclor 1016)	Not Detected	07/21/2008	0.0001	0.0005	EPA 525.2	12674-11-2
PCB (aroclor 1221)	Not Detected	07/21/2008	0.0001	0.0005	EPA 525.2	11104-28-2
PCB (aroclor 1232)	Not Detected	07/21/2008	0.0001	0.0005	EPA 525.2	11141-16-5
PCB (aroclor 1242)	Not Detected	07/21/2008	0.0001	0.0005	EPA 525.2	53469-21-9
PCB (aroclor 1248)	Not Detected	07/21/2008	0.0001	0.0005	EPA 525.2	12672-29-6
PCB (aroclor 1254)	Not Detected	07/21/2008	0.0001	0.0005	EPA 525.2	11097-69-1
PCB (aroclor 1260)	Not Detected	07/21/2008	0.0001	0.0005	EPA 525.2	11096-82-5
Polybrominated biphenyls	Not Detected	07/21/2008	0.001		EPA 525.2	59536-65-1
Prometon	Not Detected	07/21/2008	0.001		EPA 525.2	1610-18-0
Pronamide	Not Detected	07/21/2008	0.001		EPA 525.2	23950-58-5
Propachlor	Not Detected	07/21/2008	0.001		EPA 525.2	1918-16-7
Propazine	Not Detected	07/21/2008	0.001		EPA 525.2	139-40-2
Simazine	Not Detected	07/21/2008	0.0002	0.004	EPA 525.2	122-34-9
Tebuthiuron	Not Detected	07/21/2008	0.005		EPA 525.2	34014-18-1
Terbacil	Not Detected	07/21/2008	0.002		EPA 525.2	5902-51-2
Toxaphene	Not Detected	07/21/2008	0.001	0.003	EPA 525.2	8001-35-2
Trifluralin	Not Detected	07/21/2008	0.001		EPA 525.2	1582-09-8
A compound tentatively identified as 2,4-di-tert-butyl-phenol was detected.						
Volatile Organic Compounds						
1,1 Dichloroethane	Not Detected	07/18/2008	0.0005		EPA 524.2	75-34-3
1,1 Dichloroethylene	Not Detected	07/18/2008	0.0005	0.007	EPA 524.2	75-35-4
1,1 Dichloropropene	Not Detected	07/18/2008	0.0005		EPA 524.2	563-58-6
1,1,1 Trichloroethane	Not Detected	07/18/2008	0.0005	0.2	EPA 524.2	71-55-6
1,1,1,2 Tetrachloroethane	Not Detected	07/18/2008	0.0005		EPA 524.2	630-20-6
1,1,2 Trichloroethane	Not Detected	07/18/2008	0.0005	0.005	EPA 524.2	79-00-5
1,1,2,2 Tetrachloroethane	Not Detected	07/18/2008	0.0005		EPA 524.2	79-34-5
1,2 Dichlorobenzene	Not Detected	07/18/2008	0.0005	0.6	EPA 524.2	95-50-1
1,2 Dichloroethane	Not Detected	07/18/2008	0.0005	0.005	EPA 524.2	107-06-2
1,2 Dichloropropane	Not Detected	07/18/2008	0.0005	0.005	EPA 524.2	78-87-5
1,2,3 Trichlorobenzene	Not Detected	07/18/2008	0.0005		EPA 524.2	87-61-6
1,2,3 Trichloropropane	Not Detected	07/18/2008	0.0005		EPA 524.2	96-18-4
1,2,4 Trichlorobenzene	Not Detected	07/18/2008	0.0005	0.07	EPA 524.2	120-82-1
1,2,4 Trimethylbenzene	Not Detected	07/18/2008	0.0005		EPA 524.2	95-63-6
1,3 Dichlorobenzene	Not Detected	07/18/2008	0.0005		EPA 524.2	541-73-1
1,3 Dichloropropane	Not Detected	07/18/2008	0.0005		EPA 524.2	142-28-9
1,3,5 Trimethylbenzene	Not Detected	07/18/2008	0.0005		EPA 524.2	108-67-8

CAS# : Chemical Abstract Service Registry Number
MCL : Maximum Contaminant Level
AL : Action Level
RL : Reporting Limit

mg/L : milligrams / Liter (ppm)
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Lansing, MI 48909
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FAX: (517) 335-8562

Sample Number
LC26884

TESTING INFORMATION			REGULATORY INFORMATION			
Analyte Name	Result (mg/L)	Date Tested	RL (mg/L)	MCL/AL (mg/L)	Method	CAS #
Volatile Organic Compounds						
1,4 Dichlorobenzene	Not Detected	07/18/2008	0.0005	0.075	EPA 524.2	106-46-7
2,2 Dichloropropane	Not Detected	07/18/2008	0.0005		EPA 524.2	594-20-7
Benzene	Not Detected	07/18/2008	0.0005	0.005	EPA 524.2	71-43-2
Bromobenzene	Not Detected	07/18/2008	0.0005		EPA 524.2	108-86-1
Bromochloromethane	Not Detected	07/18/2008	0.0005		EPA 524.2	74-97-5
Bromodichloromethane	Not Detected	07/18/2008	0.0005	0.080	EPA 524.2	75-27-4
Bromoform	Not Detected	07/18/2008	0.0005	0.080	EPA 524.2	75-25-2
Bromomethane	Not Detected	07/18/2008	0.001		EPA 524.2	74-83-9
Carbon tetrachloride	Not Detected	07/18/2008	0.0005	0.005	EPA 524.2	56-23-5
Chlorobenzene	Not Detected	07/18/2008	0.0005	0.1	EPA 524.2	108-90-7
Chlorodibromomethane	Not Detected	07/18/2008	0.0005	0.080	EPA 524.2	124-48-1
Chloroethane	Not Detected	07/18/2008	0.0005		EPA 524.2	75-00-3
Chloroform	Not Detected	07/18/2008	0.0005	0.080	EPA 524.2	67-66-3
Chloromethane	Not Detected	07/18/2008	0.0005		EPA 524.2	74-87-3
cis-1,2 Dichloroethylene	Not Detected	07/18/2008	0.0005	0.07	EPA 524.2	156-59-2
cis-1,3 Dichloropropene	Not Detected	07/18/2008	0.0005		EPA 524.2	10061-01-5
Dibromomethane	Not Detected	07/18/2008	0.0005		EPA 524.2	74-95-3
Dichlorodifluoromethane	Not Detected	07/18/2008	0.001		EPA 524.2	75-71-8
Dichloromethane	Not Detected	07/18/2008	0.0006	0.005	EPA 524.2	75-09-2
Ethylbenzene	Not Detected	07/18/2008	0.0005	0.7	EPA 524.2	100-41-4
Fluorotrichloromethane	Not Detected	07/18/2008	0.001		EPA 524.2	75-69-4
Hexachlorobutadiene	Not Detected	07/18/2008	0.0005		EPA 524.2	87-68-3
Isopropylbenzene	Not Detected	07/18/2008	0.0005		EPA 524.2	98-82-8
m & p-Xylene	Not Detected	07/18/2008	0.0005	10	EPA 524.2	XYLMP-00-C
Methyl ethyl ketone	Not Detected	07/18/2008	0.005		EPA 524.2	78-93-3
Methyl isobutyl ketone	Not Detected	07/18/2008	0.005		EPA 524.2	108-10-1
Methyl-tert-butyl ether (MTBE)	Not Detected	07/18/2008	0.001		EPA 524.2	1634-04-4
Naphthalene	Not Detected	07/18/2008	0.0005		EPA 524.2	91-20-3
n-Butylbenzene	Not Detected	07/18/2008	0.0005		EPA 524.2	104-51-8
Nitrobenzene	Not Detected	07/18/2008	0.01		EPA 524.2	98-95-3
n-Propylbenzene	Not Detected	07/18/2008	0.0005		EPA 524.2	103-65-1
o-Chlorotoluene	Not Detected	07/18/2008	0.0005		EPA 524.2	95-49-8
o-Xylene	Not Detected	07/18/2008	0.0005	10	EPA 524.2	95-47-6
p-Chlorotoluene	Not Detected	07/18/2008	0.0005		EPA 524.2	106-43-4
p-Isopropyltoluene	Not Detected	07/18/2008	0.0005		EPA 524.2	99-87-6
sec-Butylbenzene	Not Detected	07/18/2008	0.0005		EPA 524.2	135-98-8
Styrene	Not Detected	07/18/2008	0.0005	0.1	EPA 524.2	100-42-5
tert-Butylbenzene	Not Detected	07/18/2008	0.0005		EPA 524.2	98-06-6
Tetrachloroethylene	Not Detected	07/18/2008	0.0005	0.005	EPA 524.2	127-18-4

CAS# : Chemical Abstract Service Registry Number
MCL : Maximum Contaminant Level
AL : Action Level
RL : Reporting Limit

mg/L : milligrams / Liter (ppm)
ppm : parts per million
MPN : Most Probable Number
CFU : Colony Forming Unit

Laboratory Contacts
Drinking Water Unit Mgr: Julia Pieper
Systems Mgmt. Unit Mgr: George Krisztian

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Report ID: T08G091 FINAL 07 29 08 0902

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DEQ

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
DRINKING WATER LABORATORY
USEPA Region V Drinking Water Cert. No. MI00003
P.O. Box 30270
Lansing, MI 48909
TEL: (517) 335-8184
FAX: (517) 335-8562

Sample Number
LC26884

TESTING INFORMATION			REGULATORY INFORMATION			
Analyte Name	Result (mg/L)	Date Tested	RL (mg/L)	MCL/AL (mg/L)	Method	CAS #
Volatile Organic Compounds						
Tetrahydrafuran	Not Detected	07/18/2008	0.005		EPA 524.2	109-99-9
Toluene	Not Detected	07/18/2008	0.0005	1	EPA 524.2	108-88-3
Total Trihalomethanes	Not Detected	07/18/2008		0.080	EPA 524.2	TTHM-00-C
Total Xylenes	Not Detected	07/18/2008		10	EPA 524.2	1330-20-7
trans-1,2 Dichloroethylene	Not Detected	07/18/2008	0.0005	0.1	EPA 524.2	156-60-5
trans-1,3 Dichloropropene	Not Detected	07/18/2008	0.0005		EPA 524.2	10061-02-6
Trichloroethylene	Not Detected	07/18/2008	0.0005	0.005	EPA 524.2	79-01-6
Vinyl chloride	Not Detected	07/18/2008	0.0004	0.002	EPA 524.2	75-01-4

The analyses performed by the MDEQ Drinking Water Laboratory were conducted using methods approved by the U.S. Environmental Protection Agency in accordance with the Safe Drinking Water Act, 40 CFR parts 141-143, and other regulatory agencies as appropriate.

Your local health department has detailed information about the quality of drinking water in your area. If you have concerns about the health risks related to the test results of your sample, please contact the Environmental Health Section through the address and telephone number listed below:
Unknown

CAS# : Chemical Abstract Service Registry Number
MCL : Maximum Contaminant Level
AL : Action Level
RL : Reporting Limit

mg/L : milligrams / Liter (ppm)
ppm : parts per million
MPN : Most Probable Number
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Systems Mgmt. Unit Mgr: George Krieziian

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CHAIN-OF-CUSTODY RECORD

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7/10/08 Page 1 of 1

TRACE ID NO. T08G091

TRACE USE ONLY

Logged By: [signature] Checked By: JS

Received on ice: (Yes) No Preservative Checked: Yes No N/A

Soil Volatiles Preserved: MeOH En Core Low Level Lab

Report Results To:

Client Name: RMT

Contact Person: Jennifer Overvoorde

Mailing Address: 2025 East Beltline Ave. SE Suite 402

City, State, Zip Code: Grand Rapids, MI 49546

Phone: 616-975-1098 Fax:

Email Address: jennifer.overvoorde@rmtinc.com

Project #: ~~9430.~~ 5117.08 PO #: Trace Quote #:

Project Name: 12th St Landfill Sampled by: Scot Middlebrook

Regulatory Requirements		Turnaround Requirements		Matrix Key	
MERA TMDL's	☐	Standard (2 wk)	☐	S = Soil	WI = Wipes
Drinking Water	☒	* 5 Day	☒	W = Water	LW = Liquid Waste
NPDES	☐	* 2-4 Day (RUSH)	☐	SE = Sediment	A = Air
USACE	☐	* 24 Hour (RUSH)	☐	OI = Oil	D = Drinking Water
Special	☐	* Requires prior approval		SO = Solid Waste	SL = Sludge

Bill To:

Billing Address (if different) RMT, Madison 744 Heartland trail

City, State, Zip Code Madison, WI, 53717

Attn: Phone: Fax:

Request for Analytical Services

ANALYSIS REQUESTED

TRACE NO.	DATE TAKEN	TIME TAKEN	METALS FIELD FILTERED	CLIENT SAMPLE ID	MATRIX	NUMBER OF CONTAINERS	VOC's	PCB's	metals (Sb, As, Be, Cd, Cr, Cu, Pb, Hg, Zn)	Flouride	Nitrate	Cyanide	PAH's	REMARKS	Possible Health Hazard
01	7/8/08	0901	no	RW-1	GW	5	2	2	1	X	X	X	X	X	see attached List. Needs to run against Drinking water standards.	

Please Sign

Item #	RELEASED BY	RECEIVED BY	DATE	TIME	Item #	RELEASED BY	RECEIVED BY	DATE	TIME
	1) [signature]	[signature]	7/9/08	13:23		3)			
	2)					4)			

In executing this agreement, the client acknowledges acceptance of the terms of the agreement as listed on the reverse side.

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SAMPLE LOG IN CHECKLIST

Date: 7-9-08 Client Name: RMT # of Coolers: 1

Trace ID #: T08G091 Project Name: Cooler #s:

Logged in by: Cooler #s:

Cooler Receipt

Cooler/samples delivered by: Trace courier [ ] Hand delivered [X] Commercial courier [ ] Name of delivery person:

UPS [ ] DHL [ ] FED EX [ ] US Mail [ ]

Did cooler come with a bill of lading? No [ ] Yes [ ] [X] Not Applicable Way Bill or Tracking #:

COC Seals present and intact on cooler? No [ ] Yes [ ] [X] Not Applicable

Custody seals signed by Client? No [ ] Yes [ ] Client custody seal # (if applicable):

Coolant and Temperature

Type of Coolant Used

	Yes	No
Slurry w/ crushed, cubed, or chip ice?	[ ]	[ ]
Multiple bags of ice around samples?	[X]	[ ]
Ice Packs/ Blue Ice :	[ ]	[ ]
No Coolant Present:	[ ]	

Cooler Temperature Correction Factor -0.3 °C

Date: 7-9-08 Time: 13:23

Temperature Blank: °C

Average of 3 samples: 1 °C

Melt Water: °C

Ice still present upon receipt: [X] Yes [ ] No

General

	Yes	No	NA
COC taped to inside of cooler lid?	[ ]	[X]	[ ]
All bottles arrived unbroken with labels in good condition?	[X]	[ ]	[ ]
Each sample point is in a sealed plastic bag?	[X]	[ ]	[ ]
Labels filled out completely?	[X]	[ ]	[ ]
All bottle labels agree with Chain of Custody (COC)?	[X]	[ ]	[ ]
Sufficient sample to run tests requested?	[X]	[ ]	[ ]
pH checked and samples at correct pH?	[X]	[ ]	[ ]
Correct preservative added to samples?	[X]	[ ]	[ ]
DRO/GRO samples received and appropriate check in form completed?	[ ]	[ ]	[X]
Air bubbles absent from VOAs?	[X]	[ ]	[ ]
COC filled out properly and signed by client?	[X]	[ ]	[ ]
COC signed in by TRACE sample custodian?	[X]	[ ]	[ ]
Was project manager called and samples discussed?	[ ]	[ ]	[ ]

Contact: Date:

Notes:

Rev.8 11/21/06

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APPENDIX D

Appendix D
Slope Stability Analysis From the 2007 Emergency Response Design Report

Appendix E
Slope Stability Technical Memorandum

Subject:	Slope Stability Assessment
Objective:	1. To evaluate the slope stability of the eastern slope of the 12th Street Landfill and determine a conservative final design slope for that side of the site. 2. To determine if the relocation of the paper residuals from the eastern side of the 12th Street Landfill and the sediments from the Kalamazoo River to the proposed relocation areas would pose a slope stability issue. 3. To determine the preliminary design slopes for the remainder of the landfill such that the relocation areas do not extend into areas that may need to be cut as part of the final remedial design for the 12th Street Landfill.
Approach:	▪ Identify site specific conditions that impact the stability of 12th Street Landfill slopes. ▪ Assign a range of assumed conditions to these critical site variables. ▪ Select a targeted slope and model the results using the WinSTABL computer program for the range of conditions identified. ▪ Assess the calculated safety factors against the implications of slope failure. ▪ Select appropriate conservative design slope for the eastern slope along the Kalamazoo River. ▪ Select preliminary design slope for other side slopes at the site to be used in future remedial design. ▪ Assess the slope stability of existing landfill slopes with the addition of the two proposed staging pads to be constructed as part of the Emergency Response Action.
Outcome:	Critical site-specific conditions that impact slope stability were evaluated to provide inputs to the slope stability model. The Geotechnical Assessment presented in Appendix C identified heterogeneous fill and soil materials present along the eastern slope of the 12th Street Landfill. The fill materials varied but in some instance contained layers of paper residuals. These residuals fill materials had high moisture content and fine grain sizes with resultant low shear strengths. Groundwater conditions in this evaluation included a normal level measured during water table monitoring, and a conservative level condition where river flooding occurs and saturates the fills to the top of slope. In the conservative model case, the phreatic surface in the undrained fill is assumed to follow the profile of the slope, creating excess pore pressure conditions. Finally, the slope configuration assessment considered the additional loading from relocated residuals and 3 feet of required final cover soil. Based upon this information, two design slopes were identified and modeled (*i.e.*, 4H:1V and 5H:1V) with a range of conservative input assumptions. The 5H:1V slope was shown to provide the recommended 1.5 safety factor for the full range of modeled conditions on the eastern slope. For this slope configuration, safety factors for the various conditions were predicted using the WinSTABL computer program and ranged from 1.58 to 4.18. Consideration of failure implications including the unknown nature of the fill

	materials and the potential implications of slope failure adjacent to the re-located main channel of the Kalamazoo River were factored into the selection of the 5:1 final design slope. The preliminary design slope for the remaining sides of the landfill was assumed to be 4:1 recognizing the conservative input assumptions used in this analysis and different implications associated with a possible slope failure compared with the east slope. The material relocation staging areas are not in the areas that will need to be relocated or graded later. The existing landfill side slopes that are not along the Kalamazoo River were determined to be stable with addition of less than 4 feet of fill in the material staging areas on top of the existing landfill.

Background and Overview of Approach

The rerouting of the Kalamazoo River through the former powerhouse channel has an impact on the slope stability design for the eastern side of the 12th Street Landfill in several ways. First, placement of an erosion control system will require removal of trees and regrading of the riverbank to support the rip-rap required by a permanent erosion protection system that protects the Landfill from a 500-year flood event. The resultant landfill slope needs to be stable both during and after construction and river rerouting. Secondly, the timing of the slope reshaping, originally scheduled to be performed with the Remedial Design/Remedial Action (RD/RA) scope, now needs to coincide with the Time-Critical Removal Action (TCRA) in the former Plainwell Impoundment so that the erosion protection system can be installed. Therefore, as part of the Emergency Response Action being conducted by Weyerhaeuser at the 12th Street Landfill, a series of geotechnical data collection and design activities were performed to allow completion of the final design for the eastern slope of the 12th Street Landfill.

The overall approach to the design included the following activities:

- Identify site-specific conditions that impact the stability of 12th Street Landfill slopes.

  This assessment was focused upon assessment of the types of fill and soil materials near the eastern slope and understanding the implications of groundwater and surface water elevations on site.

- Assign a range of assumed conditions to these critical site variables.

  Key variables were assigned values to define conservative input conditions for use in the predictive model.

- Select a targeted slope and model the slope stability safety factor for the range of conditions identified.

  The WinSTABL computer program was used to perform the slope stability analysis. WinSTABL was developed at the University of Wisconsin - Madison (WinSTABL, 2002) as a Windows-based platform for the PCSTABL6 developed previously by Purdue University. WinSTABL was used to perform the iterative task of identifying the factor of safety for the worst-case failure scenario for each case using the simplified Bishop method. The simplified Bishop method was used to analyze circular or rotational failure surfaces. The circular failure surface generator performs a search for the critical failure surface based on failure initiation and termination regions established by the user. The WinSTABL program was run for three different scenarios that reflected different water table elevations and material strengths. These three scenarios were run on two slope geometries 5:1 and 4:1.

- Assess the calculated safety factors against the implications of slope failure.

  A typical conservative geotechnical safety factor for static slope stability at normal conditions is 1.5; however, no factor of safety is set by Michigan planning and guidance documents. A more conservative safety factor at normal conditions is appropriate for the 12th Street Landfill based upon: 1) the heterogeneity of fill types,

volume and locations within the landfill, and 2) the significant negative implications of slope failure due to the site proximity to the Kalamazoo River.

- Select appropriate design slope for the eastern slope along the Kalamazoo River.
- Select preliminary design slope for the other side slopes of the landfill to be used in future remedial design and to identify where the relocation areas should be located.
- Assess the slope stability of existing landfill slopes with the addition of two proposed staging pads to be constructed as part of the Emergency Response Action.

Assumptions and Inputs to Model Runs

The WinSTABL model requires geometric and material strength characteristic input parameters in order to predict safety factors. Thus input parameters were established to represent a range of conditions that included the site specific groundwater conditions as well as various assumptions based upon the findings from the available geotechnical borings. The following assumptions were made to provide the needed information for the model and presented in Tables E-1 through E-3:

- **Groundwater** – Two groundwater table configurations were analyzed, one with groundwater generally matching the adjacent surface water elevation (Kalamazoo River) and wetland surface elevations (701 feet mean sea level [M.S.L.]), and the second with groundwater levels at the landfill ground surface to simulate complete saturation of soil materials and rapid drawdown following a flood event.
- **Additional fill with residuals** – Additional fill will consist of re-graded existing cover materials, paper residuals, and possibly dredged river sediments. Two cases were modeled for this layer: 1) regraded residuals without additional river sediment at a natural moisture content unit weight, and 2) regraded residuals with additional river sediments at saturated unit weight. The additional fill with river sediment was also conservatively assigned the measured mobilized strength of the paper residuals (250 psf), and the unit weight of a 1:1 mix of native sand (including river sediment) and paper residuals (81.2 pcf).
- **Existing cover** – A thin stratum (2 to 7 feet thick) of sand overlies the paper residuals. This stratum was observed in the field and laboratory investigation to have the same physical properties as the native sand below the paper residuals. Identical geotechnical properties were assigned to both layers based on laboratory results. The existing cover layer was modeled as being 2 feet thick.
- **Fill with residuals** – This fill material will stay undisturbed in place throughout remediation. The paper residuals were observed to be heterogeneous in the field investigation, (performed by RMT in May 2007) changing rapidly both by depth and lateral extent. Paper residual thicknesses for the worst-case cross section of the final slopes were determined from the proposed final regrading and existing base grades found in the field geotechnical investigation.
- **Native sand** – Strength parameters for the sand unit are based on typical values from Das (1990) and RMT experience. The native sand was modeled at an elevation of 700 feet M.S.L. The native sand was observed in soil borings to begin at this elevation across the site.
- **Material Properties** – The material properties and groundwater conditions for the slope stability analysis derived from the above information are summarized in the tables below.

The three model cases described in the tables reflect the two different groundwater elevations and vary the assumed strength of the deposited paper residual materials.

Table E-1
Model Case 1 Material Properties for 5:1 and 4:1 slopes

MATERIAL	γ_{MOIST} (pcf)	γ_{SAT} (pcf)	SHEAR STRENGTH PARAMETERS (Total Stress Conditions)		REFERENCE
			FRICTION ANGLE φ (degrees)	COHESION C (psf)	
Regraded residuals	47.4	88	10	526	RMT, 2007; BBL, 2001
Cover soil	110	131	32	0	Das, 1990; RMT , 2007
Fill with residuals	47.4	88	10	526	RMT, 2007; BBL, 2001
Sand subbase native soil	110	131	32	0	Das, 1990; RMT , 2007

Notes:

Case 1 assumes groundwater table elevation of 701 feet M.S.L.

Results for 5:1 and 4:1 model runs are presented in Attachment E-1.

Table E-2
Model Case 2 Material Properties for 5:1 and 4:1 slopes

MATERIAL	γ_{MOIST} (pcf)	γ_{SAT} (pcf)	SHEAR STRENGTH PARAMETERS (Total Stress Conditions)		REFERENCE
			FRICTION ANGLE φ (degrees)	COHESION C (psf)	
Regraded residuals	81.2	101.5	10	250	RMT, 2007; BBL, 2001
Cover soil	110	131	32	0	Das, 1990; RMT , 2007
Fill with residuals	47.4	88	10	526	RMT, 2007; BBL, 2001
Sand subbase native soil	110	131	32	0	Das, 1990; RMT , 2007

Notes:

Case 2 assumes groundwater table elevation of 701 feet M.S.L.

Table E-3
Model Case 3 Material Properties for 5:1 and 4:1 slopes

MATERIAL	γ_{MOIST} (pcf)	γ_{SAT} (pcf)	SHEAR STRENGTH PARAMETERS (Total Stress Conditions)		REFERENCE
			FRICTION ANGLE φ (degrees)	COHESION C (psf)	
Regraded residuals	81.2	101.5	10	250	RMT, 2007; BBL, 2001
Cover soil	110	131	32	0	Das, 1990; RMT , 2007
Fill with residuals	47.4	88	10	526	RMT, 2007; BBL, 2001
Sand subbase native soil	110	131	32	0	Das, 1990; RMT , 2007

Notes:

Case 3 assumes groundwater table at landfill ground surface and complete saturation of landfill materials.

Results for 5:1 and 4:1 model runs are presented in Attachment E-1.

Results

The factors of safety predicted by the WinSTABL models are summarized below:

Table E-4
Stability for 5:1 Slopes

CIRCULAR FAILURE (BISHOP)		
FACTOR OF SAFETY	Model Run	CASE MODELED
4.18	Case 1	Existing water table, existing residual strength
2.86	Case 2	Existing water table, remolded residual strength
1.58	Case 3	Water table at landfill ground surface, remolded residual strength

Table E-5
Slope Stability for 4:1 Slopes

CIRCULAR FAILURE (BISHOP)		
FACTOR OF SAFETY	Model Run	CASE MODELED
3.52	Case 1	Existing water table, existing residual strength
2.35	Case 2	Existing water table, remolded residual strength
1.30	Case 3	Water table at landfill ground surface, remolded residual strength

Discussion of Results and Design Conclusions

- Regraded slope adjacent to Kalamazoo River.

  The proposed 5:1 slope is expected to be stable under all of the modeled conditions. Subsurface material conditions likely to be encountered on a short and long term basis have been determined to be stable. Michigan solid waste regulations stipulate analysis of slope stability but do not define a required factor of safety. Traditional geotechnical design practice applies a 1.5 factor of safety requirement, and thus, the calculated factors of safety are consistent with current practice for the modeled conditions.

- Preliminary remedial design landfill side slopes.

  The preliminary proposed 4:1 side slope to be implemented at a later time for regrading the existing landfill is expected to be sufficient for maintaining a stable final slope. This slope has been selected even though the 3rd Case of complete landfill material saturation does not meet the 1.5 factor of safety. The 1.5 factor of safety should be applied to normal conditions with a lower factor of safety acceptable for models of worst case conditions. The worst case conditions of complete saturation are not likely to occur because of the extent and thickness of the hydraulically conductive sand fill that is present in the landfill. The sand will act to convey water away from the landfill and is not likely to stay saturated when above local surface water elevations. The basis for this acceptance decision is the low probability of conditions that could result in potential failure taken together with the recognition that a slope failure away from the Kalamazoo River will not have the same environmental implications. Furthermore, the slope geometery modeled for the worst case cross section along the river was subject to modeling at a 4:1 slope. That slope was determined to be stable and will be reanalyzed with constrained geometry and material properties from a future investigation conducted before final remedial design of the entire landfill. Material properties and identified geometry are expected to increase the accuracy of the model and increase the factor of safety for slope stability. Based on this information, the location of the relocation areas were selected such that relocated material will not have to be moved at a later date.

- Existing slopes of the landfill and staging of material on the landfill.

  Material placed up to 4 feet in height in the two relocation areas on top of the existing landfill proposed in the design report are expected to be stable. A majority of the existing slopes on the landfill are 3:1 to 2:1 which is steeper than proposed grades. These existing slopes have been stable since the time of their placement. Newly placed material is planned to be less than 4 feet in height and set back from the existing slopes such that regrading in the future of slopes back to 4:1 would not require relocation of the new material. The 4:1 slope modeled for future side slopes was safe at material heights in excess of 15 feet, and therefore, the thinly placed staged materials are not expected to produce slope failures.

References

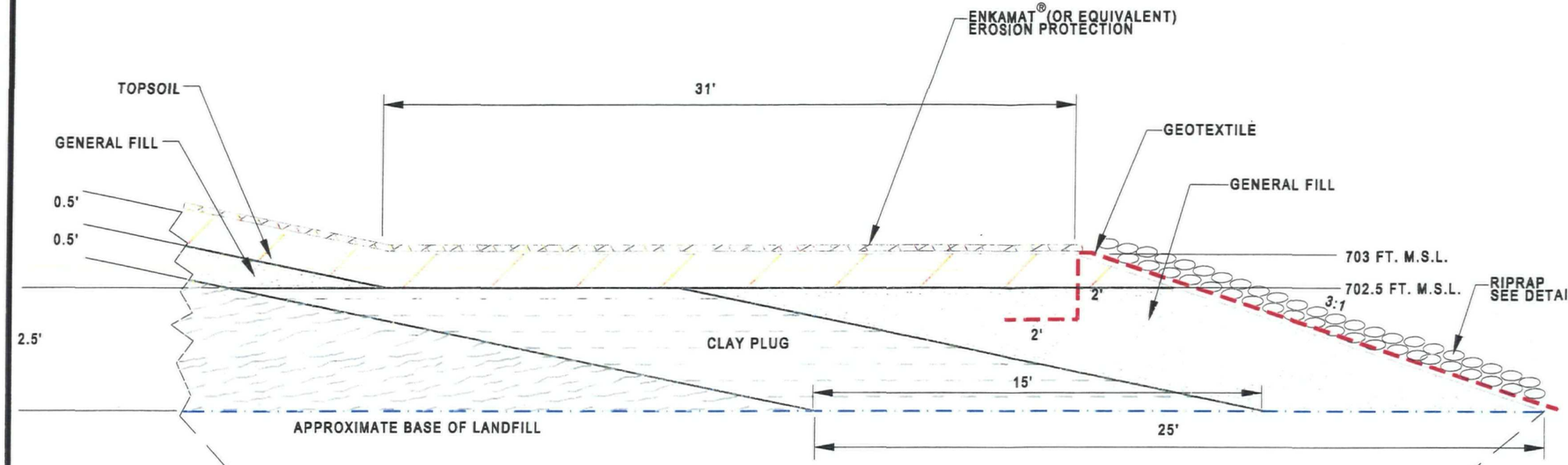
BBL. 2001. Geotechnical sample analytical data, 12th Street Landfill Operable Unit.

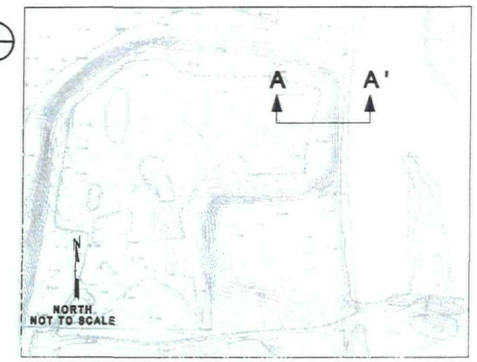
Das, B.M. 1990. Principles of foundation engineering. Second Edition. Boston Massachusetts: International Thomson Publishing.

Geraghty and Miller. 1994. Test Pit Investigation Technical Memorandum, 12th Street Landfill Operable Unit.

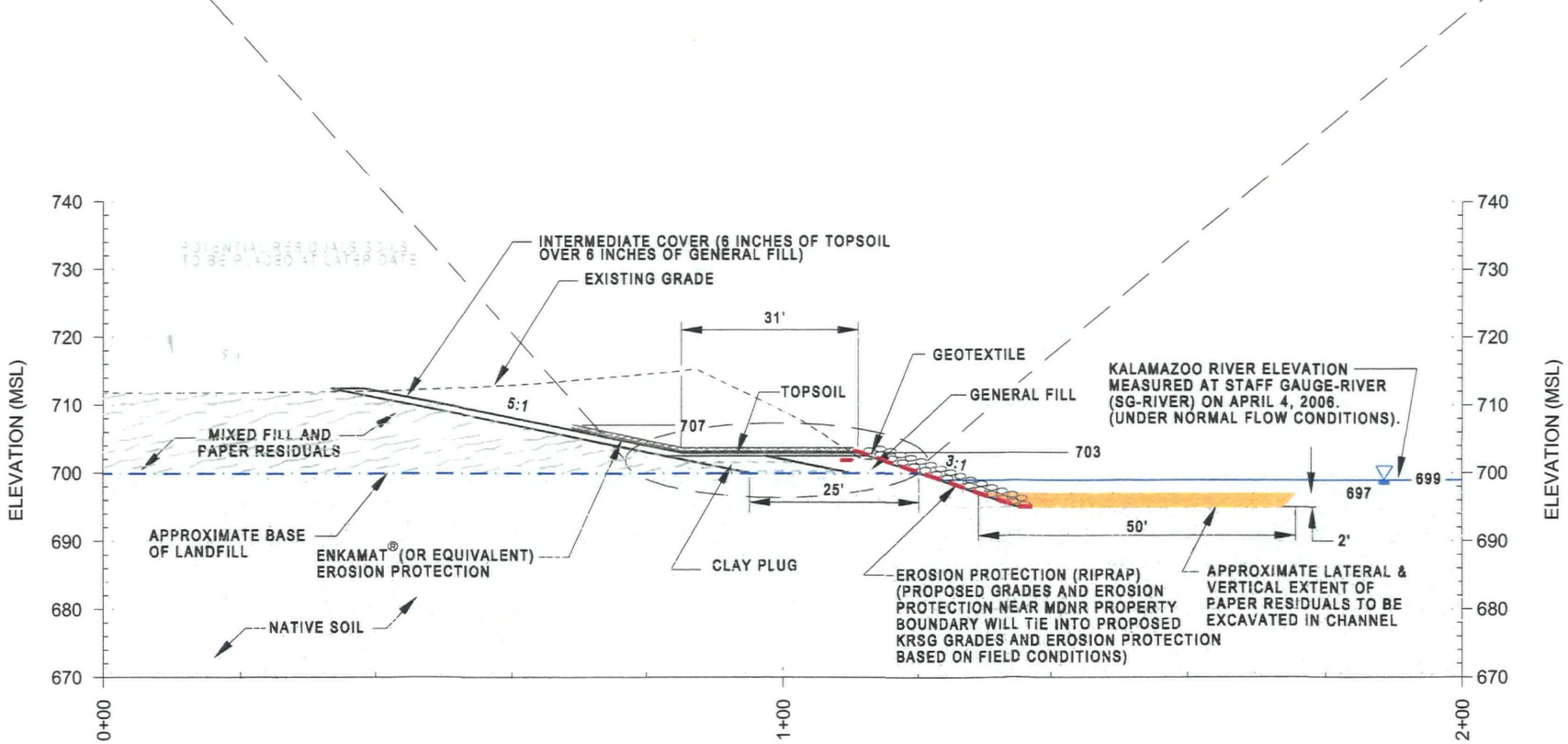
University of Wisconsin, Madison, Wisconsin. 2002. WinSTABL.

RMT, Inc. 2007. Geotechnical Investigation Technical Memorandum

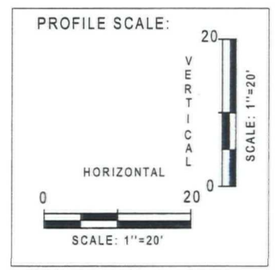




CROSS SECTION LOCATOR



CROSS SECTION A-A'
(LOOKING NORTH)

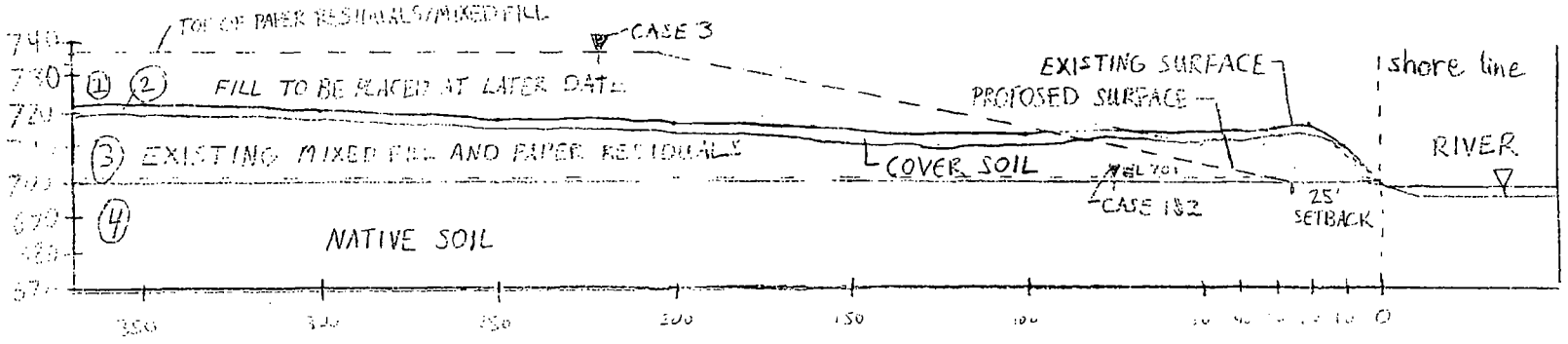


PLOT DATA
Drawing Name: J:\05117\04\ERD\xsection.dwg
Operator Name: STORMERL
Scale: 1"=20'

PROJECT:	12TH STREET LANDFILL EMERGENCY RESPONSE PLAN DESIGN REPORT OTSEGO TOWNSHIP, MICHIGAN
SHEET TITLE:	CROSS SECTION A-A'

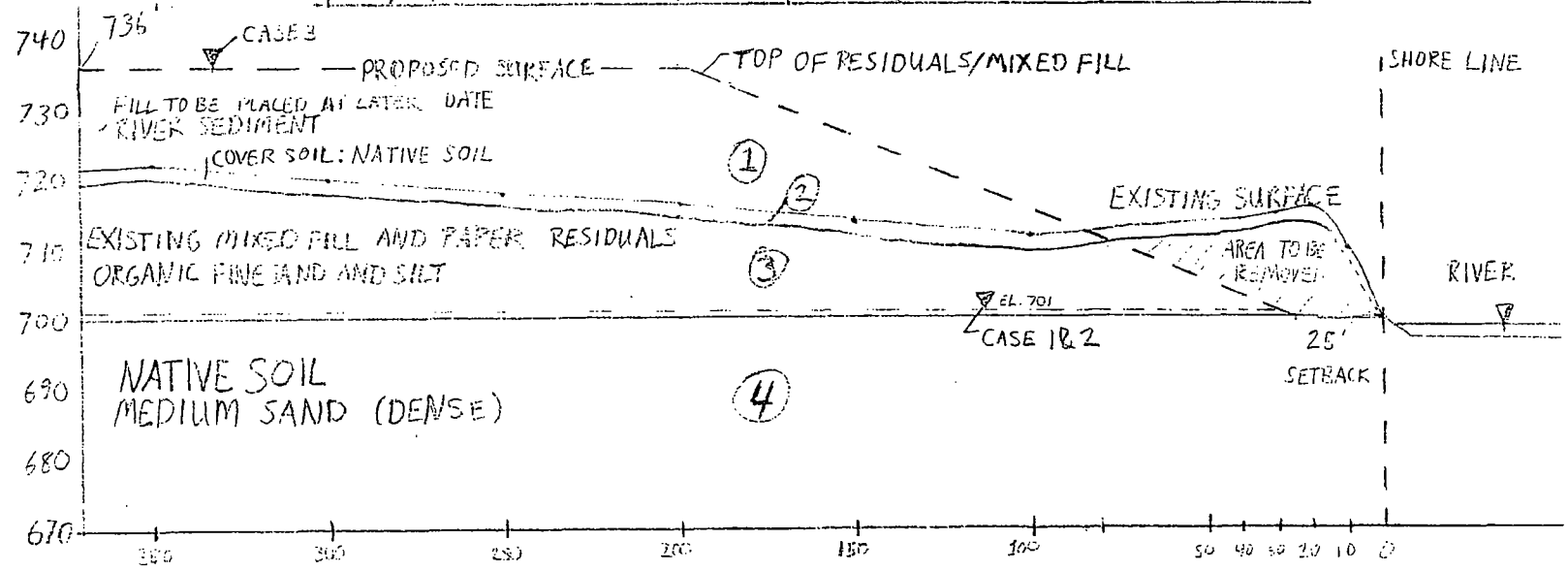
DRAWN BY: STORMERL	SCALE:	PROJ. NO.	5117.04\ERD
CHECKED BY: ECW	AS SHOWN	FILE NO.	XSECTION.DWG
APPROVED BY: MJA	DATE PRINTED:	FIGURE E-1	
DATE: JULY 2007			

RMT
744 Heartland Trail
Madison, WI 53717-1934
P.O. Box 8923 53708-8923
Phone: 608-831-4444
Fax: 608-831-3334



West Cross Section A-A' no vertical exaggeration East

Unit	Description	γ_{moist}	γ_{sat}	Cohesion (PSF)	Friction Angle (°)
1	Regraded residuals	47.4	88	526 (uu)	10
2	Cover soil	110	131	0	32
3	Fill with residuals	47.4	88	526 (uu)	10
4	Native soil	110	131	0	32

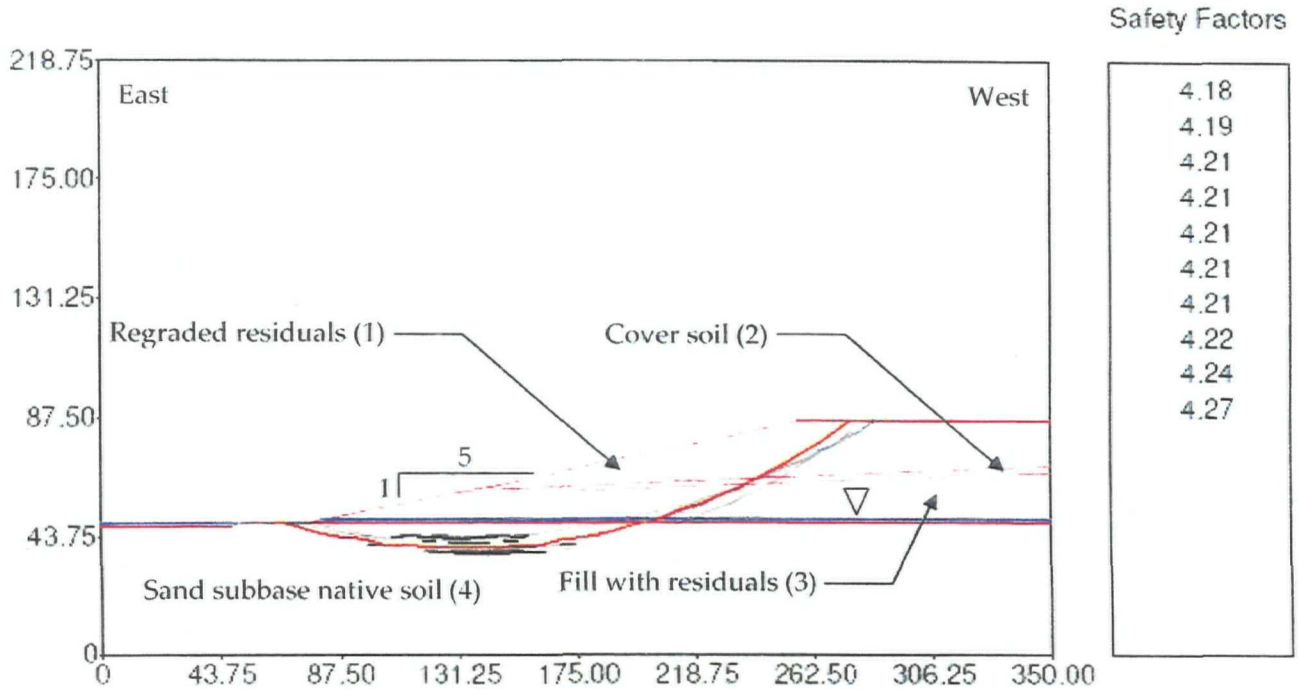


West Cross Section A-A' 2x vertical exaggeration East

RMT, Corporate Headquarters • 744 Heartland Trail 53717-1934 • P.O. Box 8923 53708-8923 • Madison, WI

PROJECT/PROPOSAL NAME/LOCATION: 12th St. Landfill			PROJECT/PROPOSAL NO. 5116.02
SUBJECT: Section A-A'			
PREPARED BY: HJH	DATE: 6/8/06	FINAL ☐	SHEET ____ OF ____
CHECKED BY:	DATE:	REVISION ☐	

Weyerhaeuser 12th Street Landfill A-A'
Case 1



P:\5116\02\CASE 1 LABELS.DOC 07/16/07

Case 2.txt
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

PROBLEM DESCRIPTION

BOUNDARY COORDINATES

7 Top Boundaries
12 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	47.50	47.50	47.50	4
2	47.50	47.50	52.50	50.00	4
3	52.50	50.00	77.50	50.00	4
4	77.50	50.00	132.50	61.00	3
5	132.50	61.00	142.50	62.50	2
6	142.50	62.50	257.50	86.00	1
7	257.50	86.00	350.00	86.00	1
8	142.50	62.50	152.50	62.00	2
9	152.50	62.00	350.00	70.00	2
10	132.50	61.00	152.50	60.00	3
11	152.50	60.00	350.00	68.00	3
12	77.50	50.00	350.00	50.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.

1	81.2	101.5	250.0	10.0	0.00	0.0	0
2	110.0	131.0	0.0	32.0	0.00	0.0	0
3	47.4	88.0	526.0	10.0	0.00	0.0	1
4	110.0	131.0	0.0	32.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	49.00
2	50.50	49.00
3	77.50	50.00
4	82.50	51.00
5	350.00	51.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 60.00 ft.
and X = 80.00 ft.

Each Surface Terminates Between X = 270.00 ft.
and X = 285.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

5.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And 44.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

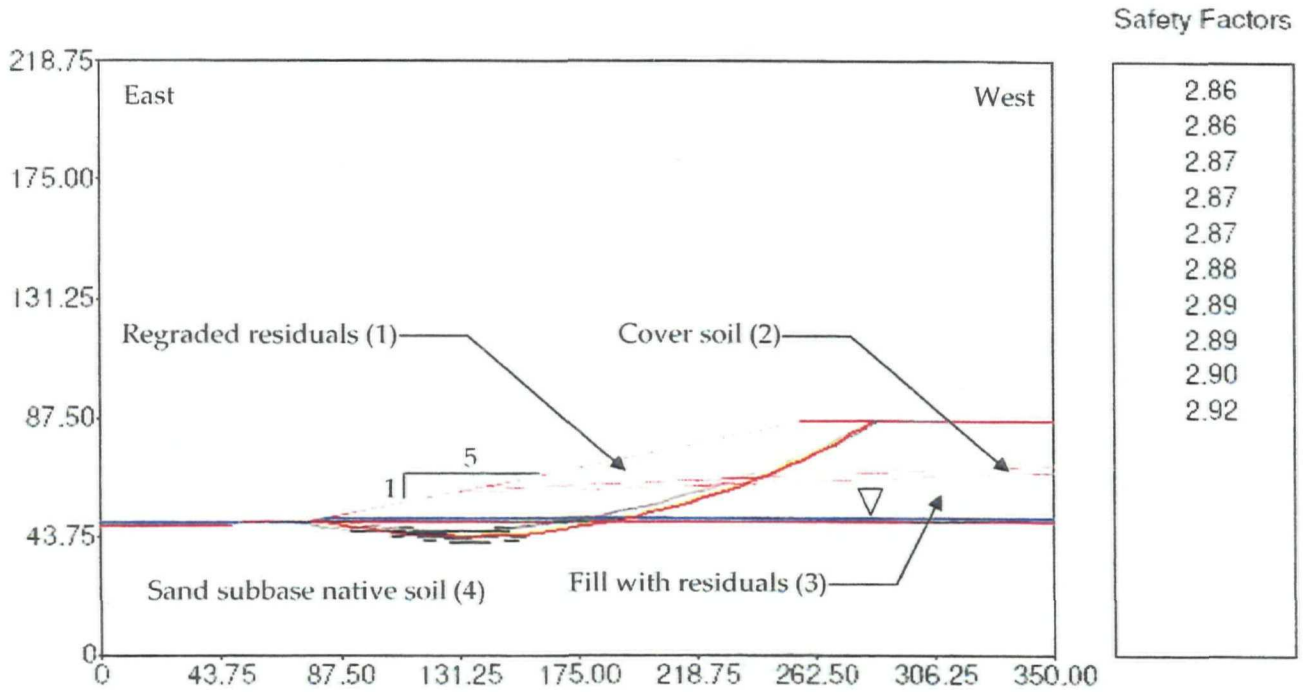
Failure Surface Specified By 44 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	77.78	50.06
2	82.69	49.11
3	87.61	48.24
4	92.55	47.46
5	97.50	46.77
6	102.47	46.17
7	107.44	45.65
8	112.42	45.22
9	117.41	44.87
10	122.40	44.62
11	127.40	44.45
12	132.40	44.36
13	137.40	44.37
14	142.40	44.46
15	147.39	44.64
16	152.39	44.90
17	157.38	45.26
18	162.36	45.70
19	167.33	46.22
20	172.29	46.84
21	177.24	47.54
22	182.18	48.32
23	187.10	49.20
24	192.01	50.15
25	196.90	51.20
26	201.77	52.33
27	206.62	53.54
28	211.45	54.84
29	216.25	56.22
30	221.03	57.69
31	225.79	59.24
32	230.51	60.87
33	235.21	62.58
34	239.88	64.38
35	244.51	66.26
36	249.11	68.21
37	253.68	70.25
38	258.21	72.37
39	262.70	74.57
40	267.15	76.84
41	271.57	79.19
42	275.94	81.62
43	280.26	84.12
44	283.38	86.00

Circle Center At X = 134.7 ; Y = 330.8 and Radius, 286.5

*** 2.858 ***

Weyerhaeuser 12th Street Landfill A-A'
Case 2



P:\51116\02\CASE 2 LABELS.DOC 07/16/07

Case 1.txt
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

PROBLEM DESCRIPTION

BOUNDARY COORDINATES

7 Top Boundaries
12 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	47.50	47.50	47.50	4
2	47.50	47.50	52.50	50.00	4
3	52.50	50.00	77.50	50.00	4
4	77.50	50.00	132.50	61.00	3
5	132.50	61.00	142.50	62.50	2
6	142.50	62.50	257.50	86.00	1
7	257.50	86.00	350.00	86.00	1
8	142.50	62.50	152.50	62.00	2
9	152.50	62.00	350.00	70.00	2
10	132.50	61.00	152.50	60.00	3
11	152.50	60.00	350.00	68.00	3
12	77.50	50.00	350.00	50.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.

1	47.4	88.0	526.0	10.0	0.00	0.0	0
2	110.0	131.0	0.0	32.0	0.00	0.0	0
3	47.4	88.0	526.0	10.0	0.00	0.0	1
4	110.0	131.0	0.0	32.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	49.00
2	50.50	49.00
3	77.50	50.00
4	82.50	51.00
5	350.00	51.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 60.00 ft.
and X = 80.00 ft.

Each Surface Terminates Between X = 270.00 ft.
and X = 285.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

5.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And 44.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

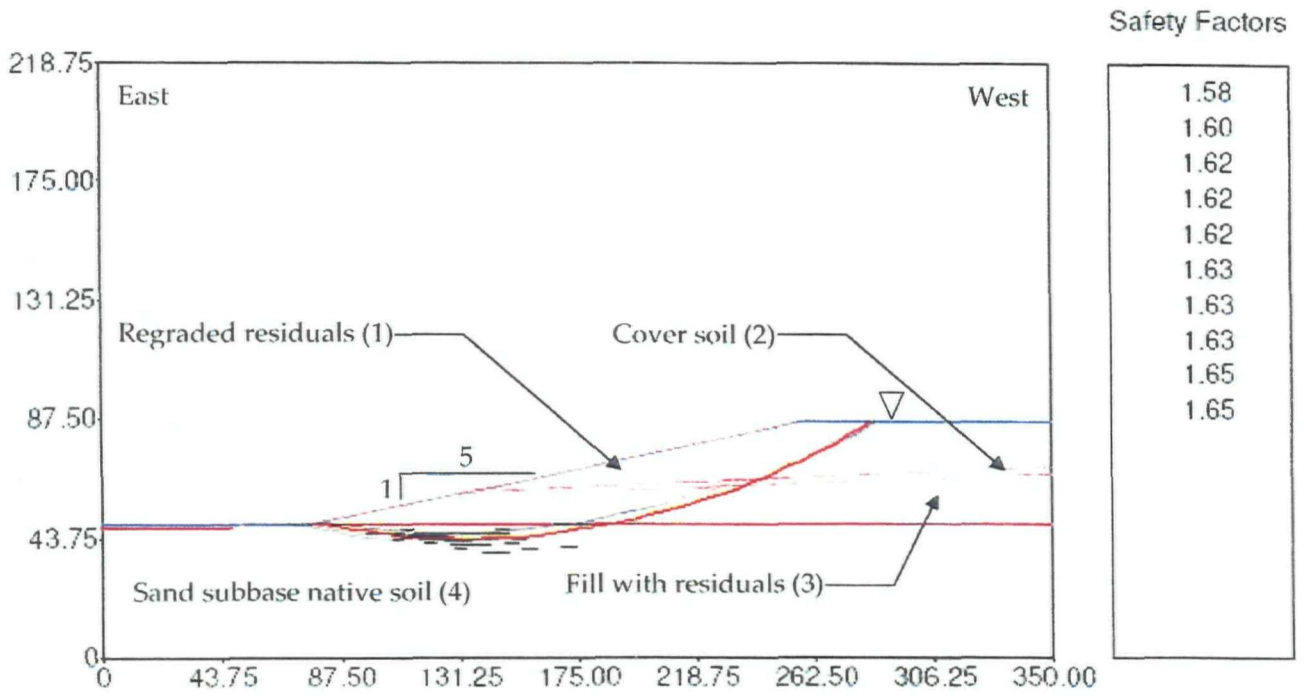
Failure Surface Specified By 46 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	64.44	50.00
2	69.25	48.61
3	74.08	47.32
4	78.94	46.14
5	83.82	45.05
6	88.72	44.06
7	93.64	43.18
8	98.58	42.40
9	103.53	41.72
10	108.50	41.14
11	113.48	40.67
12	118.46	40.30
13	123.46	40.04
14	128.45	39.87
15	133.45	39.81
16	138.45	39.86
17	143.45	40.00
18	148.44	40.26
19	153.43	40.61
20	158.41	41.07
21	163.38	41.63
22	168.34	42.29
23	173.28	43.06
24	178.20	43.93
25	183.11	44.90
26	187.99	45.97
27	192.85	47.14
28	197.68	48.41
29	202.49	49.79
30	207.27	51.26
31	212.02	52.83
32	216.73	54.50
33	221.41	56.26
34	226.05	58.13
35	230.65	60.08
36	235.21	62.14
37	239.72	64.29
38	244.19	66.53
39	248.62	68.86
40	252.99	71.28
41	257.31	73.79
42	261.58	76.40
43	265.80	79.09
44	269.95	81.86
45	274.05	84.73
46	275.80	86.00

Circle Center At X = 133.8 ; Y = 281.2 and Radius, 241.4

*** 4.185 ***

Weyerhaeuser 12th Street Landfill A-A'
Case 3



P:\5116\02\CASE 3 LABELS.DOC 07/16/07

Case 3.txt
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

PROBLEM DESCRIPTION

BOUNDARY COORDINATES

7 Top Boundaries
12 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	47.50	47.50	47.50	4
2	47.50	47.50	52.50	50.00	4
3	52.50	50.00	77.50	50.00	4
4	77.50	50.00	132.50	61.00	3
5	132.50	61.00	142.50	62.50	2
6	142.50	62.50	257.50	86.00	1
7	257.50	86.00	350.00	86.00	1
8	142.50	62.50	152.50	62.00	2
9	152.50	62.00	350.00	70.00	2
10	132.50	61.00	152.50	60.00	3
11	152.50	60.00	350.00	68.00	3
12	77.50	50.00	350.00	50.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.

1	81.2	101.5	250.0	10.0	0.00	0.0	1
2	110.0	131.0	0.0	32.0	0.00	0.0	1
3	47.4	88.0	526.0	10.0	0.00	0.0	1
4	110.0	131.0	0.0	32.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 8 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	49.00
2	50.50	49.00
3	52.50	50.00
4	77.50	50.00
5	132.50	61.00
6	142.50	62.50
7	257.50	86.00
8	350.00	86.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 60.00 ft.
and X = 80.00 ft.

Each Surface Terminates Between X = 270.00 ft.
and X = 285.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

5.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And 44.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical

First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 44 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	77.78	50.06
2	82.69	49.11
3	87.61	48.24
4	92.55	47.46
5	97.50	46.77
6	102.47	46.17
7	107.44	45.65
8	112.42	45.22
9	117.41	44.87
10	122.40	44.62
11	127.40	44.45
12	132.40	44.36
13	137.40	44.37
14	142.40	44.46
15	147.39	44.64
16	152.39	44.90
17	157.38	45.26
18	162.36	45.70
19	167.33	46.22
20	172.29	46.84
21	177.24	47.54
22	182.18	48.32
23	187.10	49.20
24	192.01	50.15
25	196.90	51.20
26	201.77	52.33
27	206.62	53.54
28	211.45	54.84
29	216.25	56.22
30	221.03	57.69
31	225.79	59.24
32	230.51	60.87
33	235.21	62.58
34	239.88	64.38
35	244.51	66.26
36	249.11	68.21
37	253.68	70.25
38	258.21	72.37
39	262.70	74.57
40	267.15	76.84
41	271.57	79.19
42	275.94	81.62
43	280.26	84.12
44	283.38	86.00

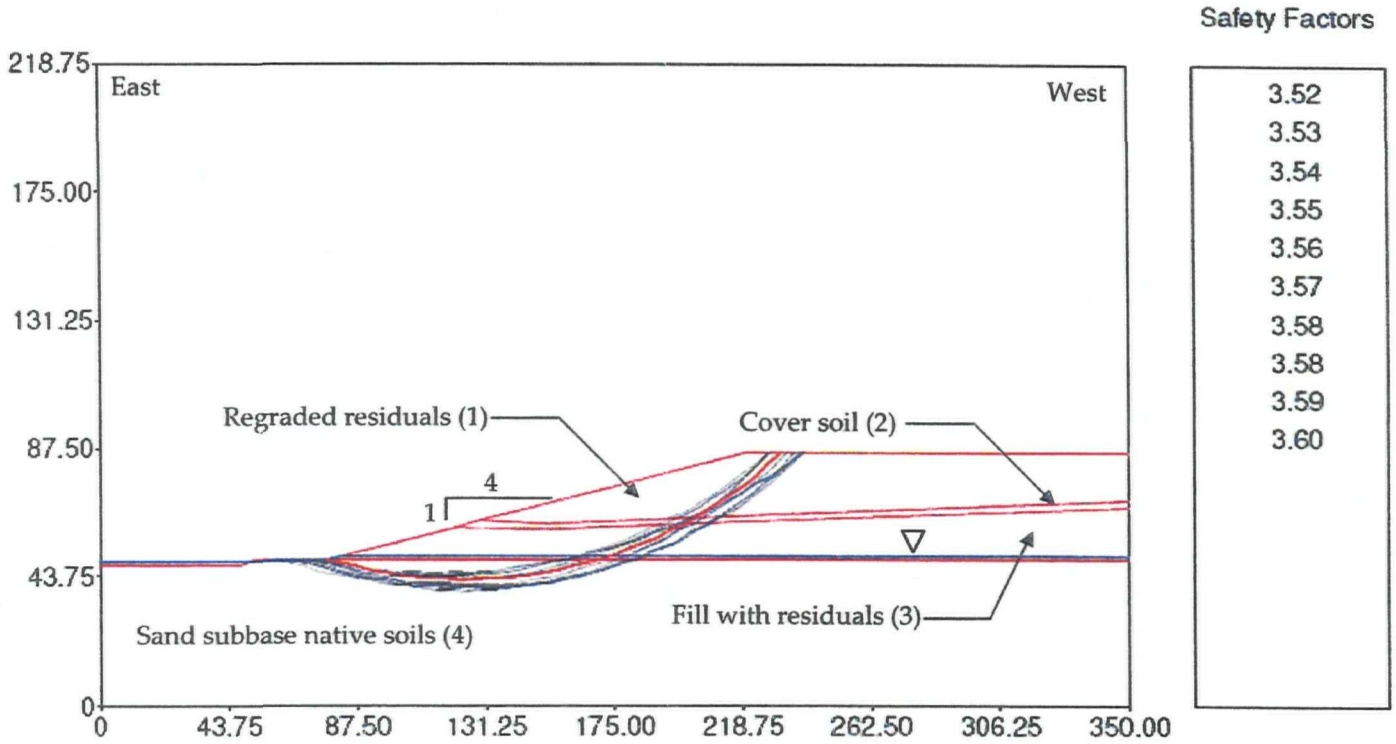
Circle Center At X = 134.7 ; Y = 330.8 and Radius, 286.5

*** 1.582 ***

Weyerhaeuser 12th Street Landfill A-A'

Case 1

4:1 slope



4-1_Case 1.txt
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

PROBLEM DESCRIPTION

BOUNDARY COORDINATES

7 Top Boundaries
12 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	47.50	47.50	47.50	4
2	47.50	47.50	52.50	50.00	4
3	52.50	50.00	77.50	50.00	4
4	77.50	50.00	121.50	61.00	3
5	121.50	61.00	129.50	63.00	2
6	129.50	63.00	221.50	86.00	1
7	221.50	86.00	350.00	86.00	1
8	129.50	63.00	152.50	62.00	2
9	152.50	62.00	350.00	70.00	2
10	121.50	61.00	152.50	60.00	3
11	152.50	60.00	350.00	68.00	3
12	77.50	50.00	350.00	50.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.

1	47.4	88.0	526.0	10.0	0.00	0.0	0
2	110.0	131.0	0.0	32.0	0.00	0.0	0
3	47.4	88.0	526.0	10.0	0.00	0.0	1
4	110.0	131.0	0.0	32.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	49.00
2	50.50	49.00
3	77.50	50.00
4	82.50	51.00
5	350.00	51.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 60.00 ft.
and X = 80.00 ft.

Each Surface Terminates Between X = 220.00 ft.
and X = 240.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

5.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And 44.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 35 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	77.78	50.07
2	82.58	48.66
3	87.42	47.41
4	92.29	46.31
5	97.21	45.37
6	102.14	44.58
7	107.10	43.96
8	112.08	43.49
9	117.07	43.17
10	122.07	43.02
11	127.07	43.03
12	132.07	43.19
13	137.06	43.52
14	142.03	44.00
15	146.99	44.64
16	151.93	45.44
17	156.83	46.40
18	161.71	47.51
19	166.55	48.78
20	171.34	50.20
21	176.09	51.77
22	180.78	53.49
23	185.42	55.36
24	189.99	57.37
25	194.50	59.54
26	198.94	61.84
27	203.30	64.28
28	207.59	66.86
29	211.78	69.58
30	215.89	72.43
31	219.91	75.41
32	223.83	78.51
33	227.65	81.74
34	231.36	85.08
35	232.32	86.00

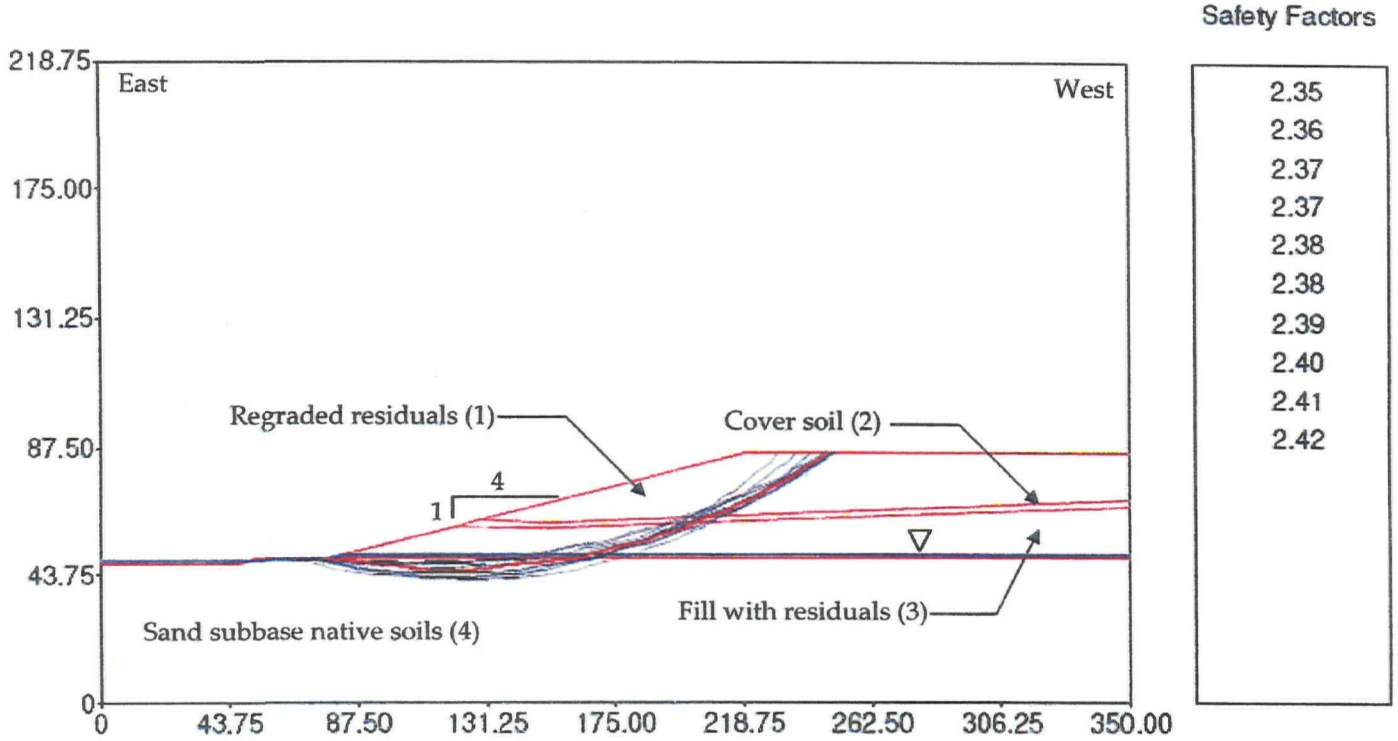
Circle Center At X = 124.4 ; Y = 200.1 and Radius, 157.1

*** 3.515 ***

Weyerhaeuser 12th Street Landfill A-A'

Case 2

4:1 slope



4-1_Case 2.txt
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

PROBLEM DESCRIPTION

BOUNDARY COORDINATES

7 Top Boundaries
12 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	47.50	47.50	47.50	4
2	47.50	47.50	52.50	50.00	4
3	52.50	50.00	77.50	50.00	4
4	77.50	50.00	121.50	61.00	3
5	121.50	61.00	129.50	63.00	2
6	129.50	63.00	221.50	86.00	1
7	221.50	86.00	350.00	86.00	1
8	129.50	63.00	152.50	62.00	2
9	152.50	62.00	350.00	70.00	2
10	121.50	61.00	152.50	60.00	3
11	152.50	60.00	350.00	68.00	3
12	77.50	50.00	350.00	50.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.

1	81.2	101.5	250.0	10.0	0.00	0.0	0
2	110.0	131.0	0.0	32.0	0.00	0.0	0
3	47.4	88.0	526.0	10.0	0.00	0.0	1
4	110.0	131.0	0.0	32.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	49.00
2	50.50	49.00
3	77.50	50.00
4	82.50	51.00
5	350.00	51.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 60.00 ft.
and X = 80.00 ft.

Each Surface Terminates Between X = 230.00 ft.
and X = 250.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

5.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And 44.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 37 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	77.78	50.07
2	82.70	49.17
3	87.63	48.38
4	92.59	47.70
5	97.56	47.14
6	102.53	46.68
7	107.52	46.34
8	112.52	46.11
9	117.52	45.99
10	122.52	45.99
11	127.52	46.09
12	132.51	46.31
13	137.50	46.65
14	142.48	47.09
15	147.45	47.65
16	152.40	48.32
17	157.34	49.10
18	162.26	49.99
19	167.16	50.99
20	172.04	52.10
21	176.89	53.32
22	181.71	54.65
23	186.49	56.08
24	191.25	57.63
25	195.97	59.28
26	200.65	61.04
27	205.29	62.90
28	209.89	64.86
29	214.44	66.93
30	218.94	69.10
31	223.40	71.37
32	227.80	73.75
33	232.15	76.22
34	236.44	78.78
35	240.67	81.44
36	244.84	84.20
37	247.43	86.00

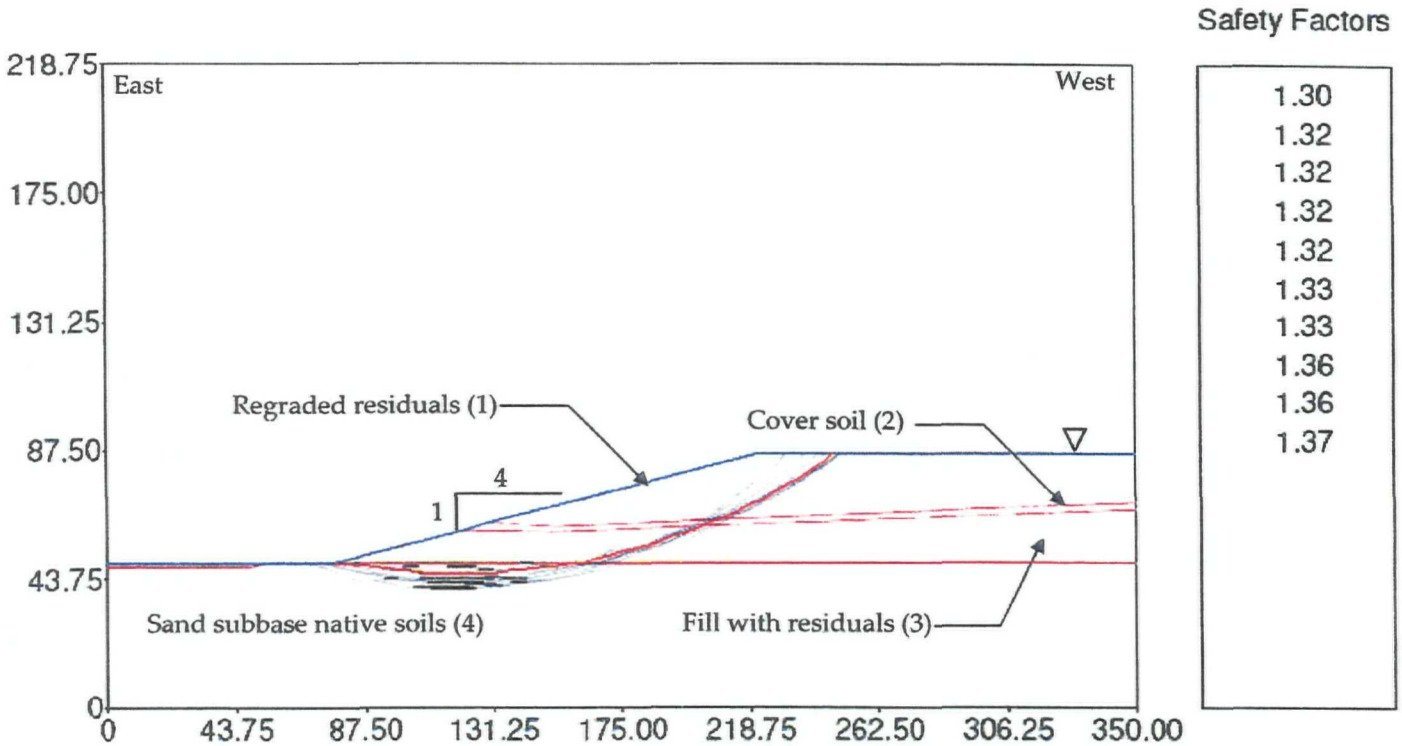
Circle Center At X = 120.2 ; Y = 268.2 and Radius, 222.2

*** 2.346 ***

Weyerhaeuser 12th Street Landfill A-A'

Case 3

4:1 slope



4-1_Case 3.txt
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

PROBLEM DESCRIPTION

BOUNDARY COORDINATES

7 Top Boundaries
12 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	47.50	47.50	47.50	4
2	47.50	47.50	52.50	50.00	4
3	52.50	50.00	77.50	50.00	4
4	77.50	50.00	121.50	61.00	3
5	121.50	61.00	129.50	63.00	2
6	129.50	63.00	221.50	86.00	1
7	221.50	86.00	350.00	86.00	1
8	129.50	63.00	152.50	62.00	2
9	152.50	62.00	350.00	70.00	2
10	121.50	61.00	152.50	60.00	3
11	152.50	60.00	350.00	68.00	3
12	77.50	50.00	350.00	50.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.

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1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 7 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	49.00
2	50.50	49.00
3	77.50	50.00
4	121.50	61.00
5	129.50	63.00
6	221.50	86.00
7	350.00	86.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

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and X = 80.00 ft.

Each Surface Terminates Between X = 230.00 ft.
and X = 250.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00 ft.

5.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And 44.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 37 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
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7	107.52	46.34
8	112.52	46.11
9	117.52	45.99
10	122.52	45.99
11	127.52	46.09
12	132.51	46.31
13	137.50	46.65
14	142.48	47.09
15	147.45	47.65
16	152.40	48.32
17	157.34	49.10
18	162.26	49.99
19	167.16	50.99
20	172.04	52.10
21	176.89	53.32
22	181.71	54.65
23	186.49	56.08
24	191.25	57.63
25	195.97	59.28
26	200.65	61.04
27	205.29	62.90
28	209.89	64.86
29	214.44	66.93
30	218.94	69.10
31	223.40	71.37
32	227.80	73.75
33	232.15	76.22
34	236.44	78.78
35	240.67	81.44
36	244.84	84.20
37	247.43	86.00

Circle Center At X = 120.2 ; Y = 268.2 and Radius, 222.2

*** 1.302 ***

APPENDIX E

Appendix E
Potential Leachate Generation Calculations

744 Heartland Trail (53717-8923) P. O. Box 8923 (53708-8923) Madison, WI (608) 831-4444 FAX: (608) 831-3334 VOICE: (608) 831-1989

PROJECT/PROPOSAL NAME	PREPARED By:	Date:	CHECKED By:	Date:	PROJECT/PROPOSAL NO.
12th Street Landfill	S. Jorgensen	7/14/08	H. Hinke	7/21/08	5117.08

POTENTIAL SETTLEMENT AND LEACHATE GENERATION DUE TO CONSOLIDATION OF PAPER RESIDUALS

Purpose:

The relocation of residuals and the addition of final cover material are expected to increase stress on existing residuals causing consolidation and discharge of leachate. This computation estimates the potential consolidation settlement and the volumetric flow rate of leachate discharged from the landfill.

Background:

The 12th Street Landfill contains paper residuals that are up to 25 feet thick in an area of approximately 6.8 acres. Paper residuals excavated during the regrading of the landfill sideslopes, and paper residuals excavated from outside of the landfill boundary will be placed on top of the existing landfill in an area of approximately 3.57 acres. A 3-foot–thick final cover will then be constructed over the landfill. The weight of the relocated paper residuals and final cover will induce consolidation settlement of the existing and relocated paper residuals. This consolidation will force excess pore water, or leachate, out of the landfill into the surrounding soils. A public ecological park is proposed over the landfill cap after final closure.

Methodology:

Soil index and strength properties for the paper residuals have been determined through previous tests performed by Blasland, Bouck & Lee, Inc. (BBL), in June 2001. Consolidation tests were performed on four undisturbed samples of the paper residuals taken from the landfill. The volume of leachate discharged from the landfill during consolidation is equal to the change in the volume of voids in a saturated condition, which is directly related to the amount of primary consolidation the paper residuals experience. The entire compressible paper residual layer was divided into 6-inch–thick sub-layers for settlement calculations to account for stress variation with depth. Because consolidation settlement is calculated using a one-dimensional model, the equation below was derived to calculate the change in void height for each sub-layer (void height is an expression used to transform the void ratio of a given material into a one-dimensional distance). Refer to the attached *Consolidation–Leachate Generation Calculation* for equation derivation and definition of terms.

$$\Delta H_w = \frac{\varepsilon_z (1 + e_o) \gamma_{sat} (H_z)}{(1 + w) G_s \gamma_w}$$

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	By:	Date:	By:	Date:	
12th Street Landfill	S. Jorgensen	7/14/08	H. Hinke	7/21/08	5117.08

The total volume of leachate generated is calculated by summing the change in void height for each sub-layer and multiplying the total change in void height by the landfill area.

$$V_w = A\sum \Delta H_w$$

The flow rate of leachate discharged from the landfill is dependent on the time rate of consolidation. The flow rate will decrease over time as the degree of consolidation increases. The flow rate of leachate can be determined for any time interval using the following equation:

$$Q_i = \frac{V_w U_i}{t_i}$$

The relocated paper residuals were analyzed independent of the existing paper residuals. This was necessary to account for the sandy cover material over the existing residuals. The relocated paper residuals were divided into four separate lifts to account for the reduced area of each lift, as well as the time it will take to place each lift. The final cover was also analyzed as a separate lift.

Secondary consolidation settlement is calculated for existing and relocated paper residuals using the following general equation:

$$S_s = C_\alpha H$$

Assumptions:

1. The worst-case scenario (BBL, 2001) was analyzed to provide a conservative answer. The greatest thickness of existing paper residuals (25 feet) was assumed for the proposed fill area (3.57 acres) based on the preliminary final grading plan. The highest compression index (Cc=0.71), secondary compression index (C_α=0.018), and coefficient of consolidation (c_v=0.02 from one to two tons per square foot) determined by consolidation tests were also used.
2. All paper residuals, existing and proposed, are fully saturated. This is a conservative assumption because moisture contents before and after consolidation tests indicate that the *in situ* paper residuals are moist, but not fully saturated. An average moisture content (w=83%), saturated density (γ_{sat}=87 pcf), void ratio (e_o=2.0), and specific gravity (G_s=2.23) were used, which account for the large variety of sample properties, including the high–water content samples at depth and the low–water content samples near the surface.
3. The water table is located at the bottom of the paper residuals, and is therefore removed from the analysis. Although the residuals and cover materials are conservatively treated as fully saturated for the analysis, RMT's field experience with similar paper residual landfills indicates that mounding of leachate/groundwater within the landfill is rare, and the

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PROJECT/PROPOSAL NAME	PREPARED		CHECKED		PROJECT/PROPOSAL NO.
	By:	Date:	By:	Date:	
12th Street Landfill	S. Jorgensen	7/14/08	H. Hinke	7/21/08	5117.08

equilibrium water table will not be affected by the placement of saturated relocated paper residuals.

4. Only primary consolidation will force leachate out of the landfill, because the excess pore water pressure within the paper residuals is dissipated after primary consolidation is complete. Secondary consolidation is the plastic adjustment of soil fabrics, and leachate generation is negligible during this time. Rainwater infiltration and groundwater through-flow leachate generation are not considered.

5. No consolidation of relocated residuals will occur during compaction, although the compaction effort will close air voids, creating a saturated state.

6. The existing and relocated paper residuals undergo virgin compression during settlement caused by the weight of relocated paper residuals. The existing residuals have already come to equilibrium with the existing state of stress and are no longer consolidating under their own weight.

7. Relocated paper residuals are placed on top of the existing sandy cover material, which overlies the existing paper residuals. As a result, the existing and relocated paper residuals are assumed to have two-way (vertical) drainage. However, because the relocated residuals are divided into four lifts for the analysis, the drainage length differs for each sub-layer depending on its location. (The heterogeneity of the landfill will offer preferential drainage paths [in all three dimensions], making it very difficult to accurately predict the actual drainage path length and the resulting time rate of consolidation.)

8. The first one-foot of relocated paper residuals (Lift 1) is placed on top of the landfill instantaneously, and the remaining relocated paper residuals and final cover are placed on top of the landfill according to the following time sequence:

	LIFT 1 (0-1')	LIFT 2 (1-5')	LIFT 3 (5-10')	LIFT 4 (10-15')	LIFT 5 (15-20')	COVER (3' thick)
Elapsed time of construction (weeks)	0	2	4	5	6	8
Area (acres)	3.57	2.93	1.79	0.97	0.39	1.84

9. The area of each lift is the average of the two bounding fill thickness contours based on the preliminary grading plan. The area of cover material is the average between the areas of the 0-feet and 20-foot fill contours.

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PROJECT/PROPOSAL NAME	PREPARED		CHECKED		PROJECT/PROPOSAL NO.
	By:	Date:	By:	Date:	
12th Street Landfill	S. Jorgensen	7/14/08	H. Hinke	7/21/08	5117.08

Results:

Because the flow rate of leachate discharged from the landfill will vary with time, final analysis results are presented as a graph of time versus flow rate. The average leachate discharge flow rate during the 8-week construction period is approximately 0.23 gallons per minute (gpm). The average leachate discharge flow rate decreases from approximately 0.1 gpm at 1 year following final cover placement to approximately 0.013 gpm at 40 years. Over 99 percent of primary consolidation occurs within 40 years; therefore, the average flow rate of the leachate discharged from the landfill during primary consolidation (40 years) is approximately 0.013 gpm, not including rainwater infiltration and groundwater through-flow.

Total primary settlement of the existing and relocated paper residuals is expected to be approximately 6.4 feet, and total secondary settlement is expected to be less than 10 inches, for a total settlement of approximately 7.2 feet in the area of maximum fill height (settlement will be considerably less in areas with less fill, such as the landfill sideslopes). Total differential settlement can be as much as half of the total settlement, or approximately 3.6 feet. Therefore, special consideration should be given to the design of any permanent structures located on the landfill.

References:

BBL. 2001. Geotechnical sample analytical data, 12th Street Landfill Operable Unit.

Attachments

- Leachate Discharge and Settlement Analysis Summary
- Leachate Discharge Flow Rate vs. Time Graph (0-1 year)
- Consolidation–Leachate Generation Calculation
- Fill Thickness Contour Plan

12th Street Landfill - Otsego Township, Michigan
Leachate Discharge and Settlement Analysis Summary

	Settlement (in)													
	Existing Residuals							Relocated Residuals						
	Lift 1	Lift 2	Lift 3	Lift 4	Lift 5	Cover	Total	Lift 2	Lift 3	Lift 4	Lift 5	Cover	Total	Total
Primary Settlement	3.2	9.3	7.6	5.3	3.7	1.9	31.1	2.9	8.0	10.8	12.5	11.7	46.0	**77.1**
Secondary Settlement							5.4						4.3	**9.7**
Total Settlement							36.5						50.3	**86.8**

		Leachate Volume (gallons)													Avg. Flow Rate	
Time	Time	Existing Residuals							Relocated Residuals							Total
(weeks)	(years)	Lift 1	Lift 2	Lift 3	Lift 4	Lift 5	Cover	Total	Lift 2	Lift 3	Lift 4	Lift 5	Cover	Total	Total	(gal/year)	(gal/min)
	0	~	~	~	~	~	~	0	~	~	~	~	~	0	**0**	0	**0**
0.52	0.01	650	~	~	~	~	~	650	~	~	~	~	~	0	**650**	65,035	**0.124**
2	0.038	1,274	487	~	~	~	~	1,761	757	~	~	~	~	757	**2,518**	66,265	**0.126**
4	0.077	1,801	3,017	244	~	~	~	5,062	2,345	641	~	~	~	2,986	**8,048**	104,516	**0.199**
5	0.096	2,014	3,695	1,068	92	~	~	6,868	1,915	1,871	314	~	~	4,099	**10,968**	114,247	**0.217**
6	0.115	2,206	4,267	1,510	403	26	~	8,411	1,658	1,985	1,030	109	~	4,782	**13,193**	114,722	**0.218**
8	0.153	2,547	5,225	2,135	697	161	64	10,830	2,031	2,807	1,785	674	483	7,780	**18,610**	121,632	**0.231**
	0.5	4,599	10,448	5,014	1,848	510	1,186	23,604	4,060	6,590	4,729	2,137	8,993	26,509	**50,114**	100,227	**0.191**
	1	6,504	15,093	7,406	2,765	773	1,853	34,394	5,866	9,735	7,075	3,240	14,054	39,969	**74,363**	74,363	**0.141**
	1.153	6,983	16,251	7,997	2,990	838	2,014	37,072	6,316	10,511	7,650	3,508	15,271	43,257	**80,328**	69,669	**0.133**
	10	19,840	46,994	23,518	8,871	2,508	6,144	107,875	17,009	28,790	21,140	9,784	43,398	120,121	**227,995**	22,800	**0.043**
	40	26,450	62,650	31,353	11,826	3,344	8,191	143,815	19,625	33,217	24,391	11,288	50,071	138,593	**282,408**	7,060	**0.013**

Note: The values in each column represent the leachate/settlement generated by the placement of the lift noted in the top row.

Time Interval		Description	Leachate Volume (gallons)	Cumulative Volume (gallons)	Avg. Flow Rate (gal/year)	(gal/min)
0	3.7 days	Placement of Lift 1 (0-1')	650	650	65,035	0.124
3.7 days	2 weeks	Placement of Lift 2 (1-5')	1,868	2,518	66,704	0.127
2 weeks	4 weeks	Placement of Lift 3 (5-10')	5,530	8,048	141,786	0.270
4 weeks	5 weeks	Placement of Lift 4 (10-15')	2,920	10,968	153,684	0.292
5 weeks	6 weeks	Placement of Lift 5 (15-20')	2,225	13,193	117,123	0.223
6 weeks	8 weeks	Placement of Cover (3' thick)	5,417	18,610	142,541	0.271
				Average flow rate during construction =		**0.231**
8 weeks	1 year 8 weeks	1 year after cover placement	61,719	80,328	61,719	0.117
1 year 8 weeks	10 years	Consolidation	147,667	227,995	16,691	0.032
10 years	40 years	Consolidation	54,412	282,408	1,814	0.003
				Average flow rate after construction =		**0.013**

By: S. Jorgensen Date: 7/14/08 Revised: 8/5/2008
Checked: H. Hinke Date: 7/21/08 Checked: 8/6/2008

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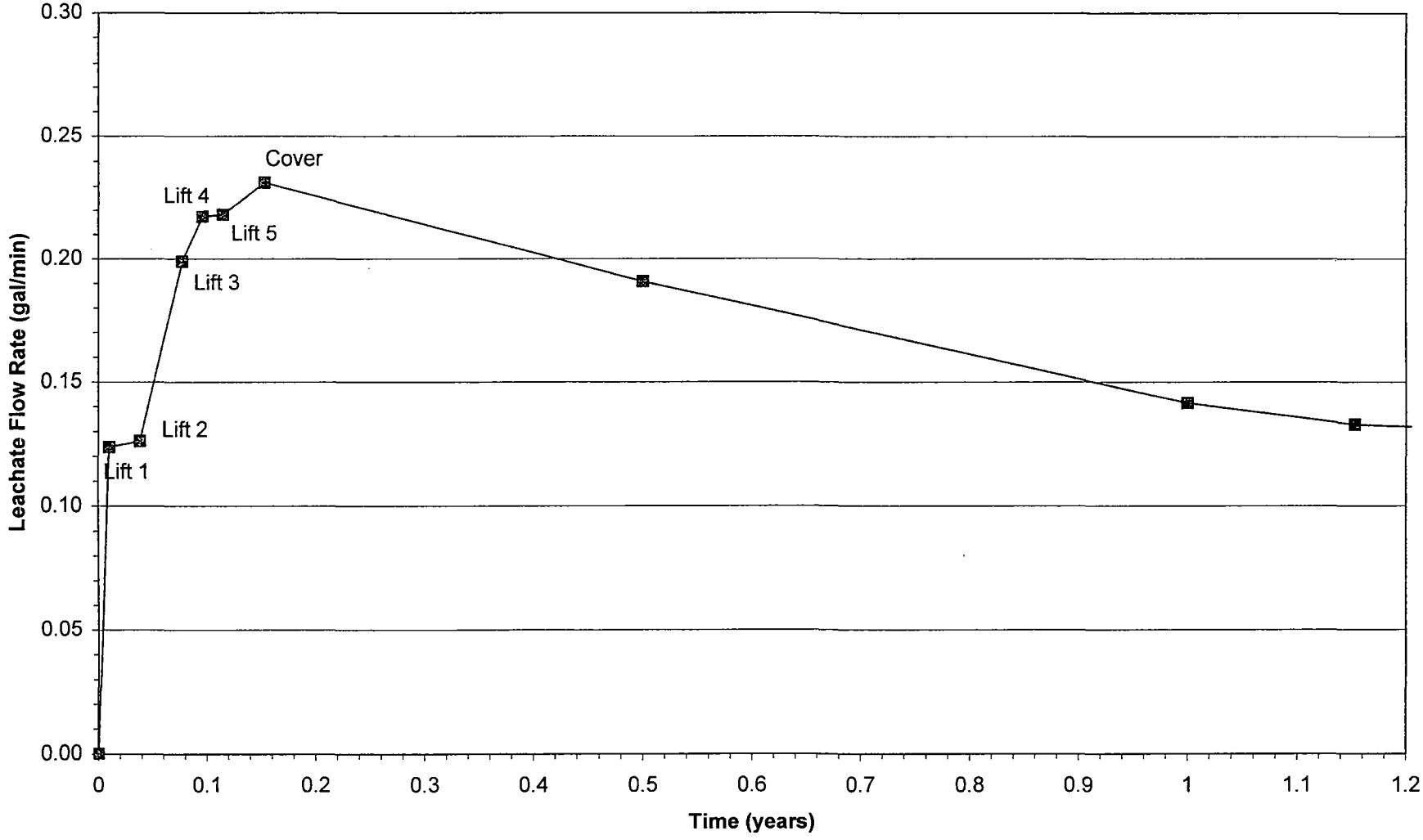
Average Leachate Discharge Flow Rate vs. Time
12th Street Landfill - Otsego Township, Michigan



By: S. Jorgensen Date: 7/14/08 Revised: 8/5/08
Checked: H. Hinke Date: 7/21/08 Checked: 8/6/08

P:\5117\07\Leachate\SC-38 Consolidation 12th St Landfill refined 8-5-08.xls 8/6/2008

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PROJECT/PROPOSAL NAME/LOCATION: 12th St. Landfill - Michigan		PROJECT/PROPOSAL NO. 5117.08
SUBJECT: Consolidation / Leachate Generation Calcs.		
PREPARED BY: Sam Jorgensen	DATE: 5/21/08	FINAL ☐
CHECKED BY: H. Hmike	DATE: 6/16/08	REVISION ☐

Purpose: To determine the flow rate of leachate discharged from the 12th St. Landfill due to the consolidation of existing paper residuals caused by the added stress from proposed relocated paper residuals placed on top of the existing landfill.

Methodology: Primary Consolidation Settlement

- Divide the entire compressible layer into smaller sublayers (0.5' thick)
- Strain within each layer (for virgin compression)

$$\varepsilon_z = C_{EC} \log\left(\frac{P_f}{P_o}\right) \qquad C_{EC} = \frac{C_c}{1+e_o}$$

$$C_{EC} = \frac{\Delta\varepsilon}{\log(P_f/P_o)} \qquad C_c = \frac{\Delta e}{\log(P_f/P_o)} \Rightarrow \frac{\Delta\varepsilon}{C_{EC}} = \frac{\Delta e}{C_c}$$

$$\frac{\Delta\varepsilon(1+e_o)}{C_c} = \frac{\Delta e}{C_c} \Rightarrow \Delta e = \Delta\varepsilon(1+e_o)$$

- For Saturated conditions, Volume voids (V_v) = Volume water (V_w)

$$e = \frac{V_v}{V_s} = \frac{V_w}{V_s} \Rightarrow \Delta V_w = \Delta e V_s = \Delta\varepsilon(1+e_o)V_s$$

- Divide by area to make 1-dimensional

$$\frac{\Delta V_w}{A} = \frac{\Delta\varepsilon(1+e_o)V_s}{A} \Rightarrow \Delta H_w = \Delta\varepsilon(1+e_o)H_s$$

- Volume of Solids (V_s): $V_s = \frac{W_s}{G_s\gamma_w}$, divide by area to make 1-D

$$H_s = \frac{\beta_s}{G_s\gamma_w} = \frac{\gamma_d(H_z)}{G_s\gamma_w} = \frac{\gamma_{sat}(H_z)}{(1+w)G_s\gamma_w}$$

- Change in height of water for each layer: $\boxed{\Delta H_w = \frac{\varepsilon_z(1+e_o)\gamma_{sat}(H_z)}{(1+w)G_s\gamma_w}}$
- Total leachate volume: $\boxed{V_w = A \cdot \sum \Delta H_w}$

PROJECT/PROPOSAL NAME/LOCATION: 12th St. Landfill - Michigan		PROJECT/PROPOSAL NO.
SUBJECT: Consolidation / Leachate Generation Calcs.		
PREPARED BY: Sam Torgersen	DATE: 5/21/08	FINAL ☐
CHECKED BY: H. Hinke	DATE: 6/06/08	REVISION ☐

Time Rate of Consolidation:

$$t = \frac{T_v H_{dl}^2}{C_v}$$

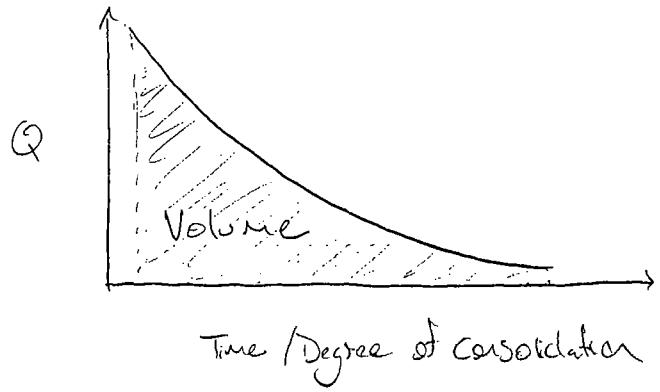
⇒ Flow rate of leachate discharging from landfill:

$$Q = \frac{V_w}{t}$$

Flow rate values w/ time / degree of consolidation:

⇒ at a given time interval / degree of consol.

$$Q_i = \frac{V_w \times U_i}{t_i}$$



- Area under curve = Volume

PROJECT/PROPOSAL NAME/LOCATION: 12th St. Landfill - Michigan		PROJECT/PROPOSAL NO.
SUBJECT: Consolidation / Leachate Generation Calcs		
PREPARED BY: Sam Jorgensen	DATE: 5/21/08	FINAL ☐
CHECKED BY: H. Hinkle	DATE: 6/16/08	REVISION ☒ 7/15/08

Definition of Terms:

ε = Strain on compressible soil layer (calculated)

C_c = Compression Index ($C_c = 0.71$)

P_f = Final stress soil experiences (calculated)

P_o = Initial stress soil experiences (calculated)

e_o = Initial void ratio ($e_o = 2.0$)

V_v = Volume of voids (calc.)

V_w / H_w = Volume / Height of water (Calc.)

V_s / H_s = Volume / Height of solids (Calc.)

A = Area of Landfill (Varies - Fill area based on prelim. final grading plan)

W_s = weight of solids

ρ_s = density of solids

G_s = Specific Gravity ($G_s = 2.23$)

γ_w = unit weight of water (62.4 lbs/ft³)

γ_d = dry unit weight of soil ($\gamma_d = 47.4$)

γ_{sat} = Saturated unit weight of soil ($\gamma_{sat} = \gamma_d(1+w) = (47.4)(1.83) = 87$ pcf)

w = Saturated water content ($w = 83\%$)

H_z = Height of compressible soil layer - Subdivided ($H_z = 0.5$ ft)

t = time rate of consolidation (calc)

H_{dr} = drainage length (Existing Residuals: $H_{dr} = 12.5'$, Relocated: Varies (2.5'-10'))

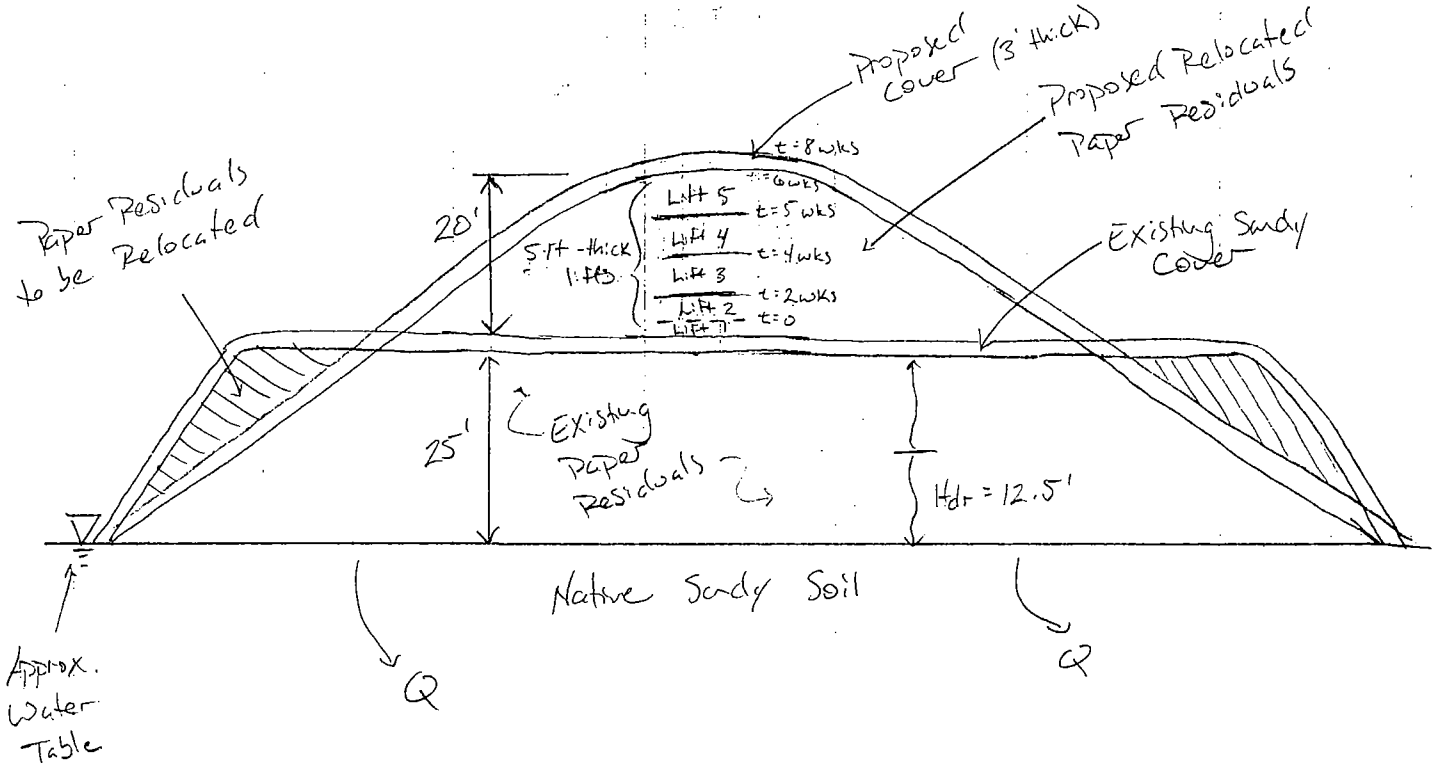
C_v = coefficient of consolidation ($C_v = 0.02$)

T_v = time factor (calc)

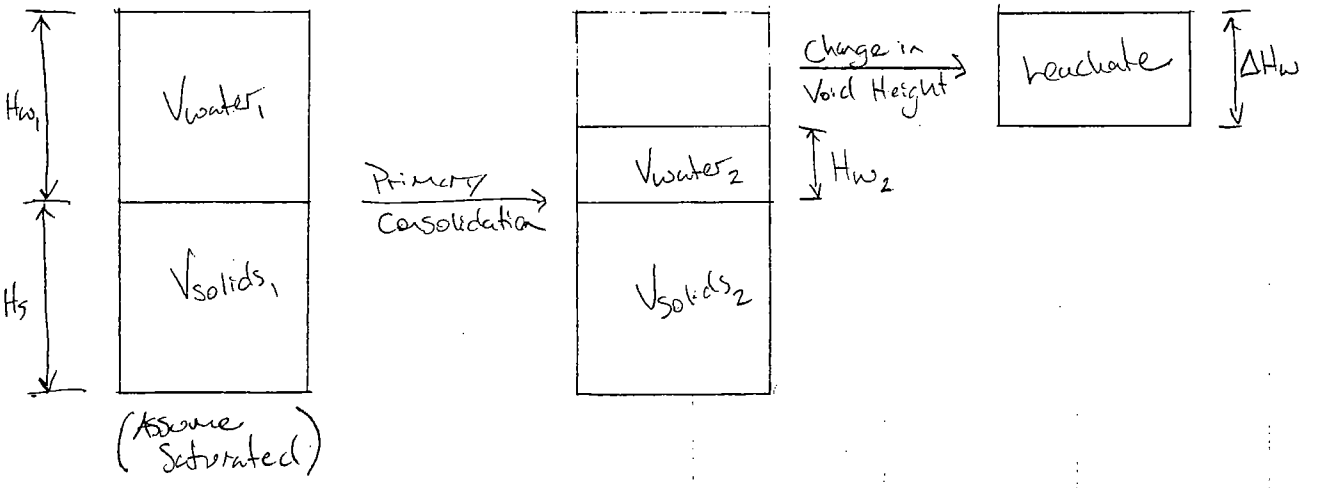
U = Average degree of consolidation (calc)

PROJECT/PROPOSAL NAME/LOCATION: 12th St. Landfill - Michigan		PROJECT/PROPOSAL NO. 5117.08
SUBJECT: Consolidation / Leachate Generation Calcs		
PREPARED BY: Sam Torgersen	DATE: 6/9/08	FINAL ☐
CHECKED BY: A. Hinkle	DATE: 6/16/08	REVISION ☒ 7/15/08

Cross Section (Not to Scale)



Soil Phase Diagram



SETTLEMENT ANALYSIS OF SHALLOW FOUNDATIONS
Classical Method

Date: August 6, 2008
Identification: 12th St Landfill - Existing Residuals, Lift 1 (0-1')

Existing Residuals

Void Ratio	2	
Sat Density	87	pcf
w	0.83	
Gs	2.23	

Leachate Generation

Total change in void height	0.275	in
Landfill Area	3.57	acre
Total Leachate Volume	26,665	gal

Input

Units	E	E or SI
Shape	sq	SQ, CI, CO, or RE
B =	395	ft
L =	395	ft
D =	0	ft
P =		k
Dw =	100	ft
r =	1	

Primary Settlement Results

Surcharge =	87	lb/ft^2
Primary Settlement =	3.22	in

Overburden

	87	pcf
	0	ft
Cover	131	psf
	131	psf

Relocated Residuals

Bulk Density	87	pcf
Thickness	1	ft
Cover	0	psf
dded Stress	87	psf

Time Rate of Consolidation

Drainage Length	12.5 ft
c(v)	0.02 ft^2/day

Avg. Degree of Consolidatio	Tv	Time (years)	Volume (gal)	Flowrate (gal/year)
1%	0.00008	0.002	267	155,724
10%	0.00785	0.168	2,667	15,870
20%	0.0314	0.672	5,333	7,935
30%	0.0707	1.513	8,000	5,286
40%	0.126	2.697	10,666	3,955
50%	0.197	4.217	13,333	3,162
60%	0.286	6.122	15,999	2,614
70%	0.403	8.626	18,666	2,164
80%	0.567	12.136	21,332	1,758
90%	0.848	18.151	23,999	1,322
99%	1.781	38.121	26,398	692

Lift	Time (weeks)	Time (years)	Tv	Avg. Degree of Consolidation	Volume (gal)	Flowrate (gal/year)
		0.01	0.000467	2.44%	650	65,035
1	2	0.038356	0.001792	4.78%	1,274	33,207
2	4	0.076712	0.003584	6.76%	1,801	23,481
3	5	0.09589	0.00448	7.55%	2,014	21,002
4	6	0.115068	0.005376	8.27%	2,206	19,172
Cover	8	0.153425	0.007168	9.55%	2,547	16,604
		0.5	0.02336	17.25%	4,599	9,197
		1	0.04672	24.39%	6,504	6,504
		10	0.4672	74.41%	19,840	1,984
		40	1.8688	99.19%	26,450	661
		1.153	0.053868	26.19%	6,983	6,057

Secondary Consolidation Results

C(alpha)	0.018
Layer Thickness (ft)	25
Secondary Settlement (in)	5.4

Depth to Soil Layer Top (ft)	Bottom (ft)	Cc/(1+e)	Cr/(1+e)	sigma m' (lb/ft^2)	gamma (lb/ft^3)	zf (ft)	sigma c' (lb/ft^2)	sigma zo' (lb/ft^2)	delta sigma (lb/ft^2)	sigma zf' (lb/ft^2)	strain (%)	Settlement (in)	Change in Void Height (in)
0.0	0.0				87								
0.0	0.5	0.237		0	87	0.25	153	153	87	240	4.640	0.278	0.024
0.5	1.0	0.237		0	87	0.75	196	196	87	283	3.777	0.227	0.019
1.0	1.5	0.237		0	87	1.25	240	240	87	327	3.187	0.191	0.016
1.5	2.0	0.237		0	87	1.75	283	283	87	370	2.757	0.165	0.014
2.0	2.5	0.237		0	87	2.25	327	327	87	414	2.430	0.146	0.012
2.5	3.0	0.237		0	87	2.75	370	370	87	457	2.172	0.130	0.011
3.0	3.5	0.237		0	87	3.25	414	414	87	501	1.964	0.118	0.010
3.5	4.0	0.237		0	87	3.75	457	457	87	544	1.793	0.108	0.009
4.0	4.5	0.237		0	87	4.25	501	501	87	588	1.649	0.099	0.008
4.5	5.0	0.237		0	87	4.75	544	544	87	631	1.526	0.092	0.008
5.0	5.5	0.237		0	87	5.25	588	588	87	675	1.421	0.085	0.007
5.5	6.0	0.237		0	87	5.75	631	631	87	718	1.329	0.080	0.007
6.0	6.5	0.237		0	87	6.25	675	675	87	762	1.248	0.075	0.006
6.5	7.0	0.237		0	87	6.75	718	718	87	805	1.177	0.071	0.006
7.0	7.5	0.237		0	87	7.25	762	762	87	849	1.113	0.067	0.006
7.5	8.0	0.237		0	87	7.75	805	805	87	892	1.056	0.063	0.005
8.0	8.5	0.237		0	87	8.25	849	849	87	936	1.004	0.060	0.005
8.5	9.0	0.237		0	87	8.75	892	892	87	979	0.958	0.057	0.005
9.0	9.5	0.237		0	87	9.25	936	936	87	1023	0.915	0.055	0.005
9.5	10.0	0.237		0	87	9.75	979	979	87	1066	0.876	0.053	0.004
10.0	10.5	0.237		0	87	10.25	1023	1023	87	1110	0.840	0.050	0.004
10.5	11.0	0.237		0	87	10.75	1066	1066	87	1153	0.807	0.048	0.004
11.0	11.5	0.237		0	87	11.25	1110	1110	87	1197	0.777	0.047	0.004
11.5	12.0	0.237		0	87	11.75	1153	1153	87	1240	0.748	0.045	0.004
12.0	12.5	0.237		0	87	12.25	1197	1197	87	1284	0.722	0.043	0.004
12.5	13.0	0.237		0	87	12.75	1240	1240	87	1327	0.698	0.042	0.004
13.0	13.5	0.237		0	87	13.25	1284	1284	87	1371	0.675	0.040	0.003
13.5	14.0	0.237		0	87	13.75	1327	1327	87	1414	0.653	0.039	0.003
14.0	14.5	0.237		0	87	14.25	1371	1371	87	1458	0.633	0.038	0.003
14.5	15.0	0.237		0	87	14.75	1414	1414	87	1501	0.614	0.037	0.003
15.0	15.5	0.237		0	87	15.25	1458	1458	87	1545	0.596	0.036	0.003
15.5	16.0	0.237		0	87	15.75	1501	1501	87	1588	0.580	0.035	0.003
16.0	16.5	0.237		0	87	16.25	1545	1545	87	1632	0.564	0.034	0.003
16.5	17.0	0.237		0	87	16.75	1588	1588	87	1675	0.549	0.033	0.003
17.0	17.5	0.237		0	87	17.25	1632	1632	87	1719	0.534	0.032	0.003
17.5	18.0	0.237		0	87	17.75	1675	1675	87	1762	0.521	0.031	0.003
18.0	18.5	0.237		0	87	18.25	1719	1719	87	1806	0.508	0.030	0.003
18.5	19.0	0.237		0	87	18.75	1762	1762	87	1849	0.496	0.030	0.003
19.0	19.5	0.237		0	87	19.25	1806	1806	87	1893	0.484	0.029	0.002
19.5	20.0	0.237		0	87	19.75	1849	1849	87	1936	0.473	0.028	0.002
20.0	20.5	0.237		0	87	20.25	1893	1893	87	1980	0.462	0.028	0.002
20.5	21.0	0.237		0	87	20.75	1936	1936	87	2023	0.452	0.027	0.002
21.0	21.5	0.237		0	87	21.25	1980	1980	87	2067	0.442	0.027	0.002
21.5	22.0	0.237		0	87	21.75	2023	2023	87	2110	0.433	0.026	0.002
22.0	22.5	0.237		0	87	22.25	2067	2067	87	2154	0.424	0.025	0.002
22.5	23.0	0.237		0	87	22.75	2110	2110	87	2197	0.415	0.025	0.002
23.0	23.5	0.237		0	87	23.25	2154	2154	87	2241	0.407	0.024	0.002
23.5	24.0	0.237		0	87	23.75	2197	2197	87	2284	0.399	0.024	0.002
24.0	24.5	0.237		0	87	24.25	2241	2241	87	2328	0.392	0.023	0.002
24.5	25.0	0.237		0	87	24.75	2284	2284	87	2371	0.384	0.023	0.002
25.0	25.5			-2306		25.25		2306	87	2393	#NUM!	#NUM!	
25.5	26.0			-2306		25.75		2306	87	2393	#NUM!	#NUM!	

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SETTLEMENT ANALYSIS OF SHALLOW FOUNDATIONS
Classical Method

Date: August 6, 2008
Identification: 12th St Landfill - Existing Residuals, Lift 2 (1-5')

Input

Units	E	E or SI	
Shape	sq	SQ, CI, CO, or RE	
B =	360	ft	
L =	360	ft	
D =	0	ft	
P =	k		
Dw =	100	ft	
r =	1		

Overburden

	87	pcf
	1	ft
	131	psf
	218	psf

Existing Residuals

Void Ratio	2	
Sat Density	87	pcf
w	0.83	
Gs	2.23	

Primary Settlement Results

Surcharge =	348	lb/ft^2
Primary Settlement =	9.29	in

Relocated Residuals

Bulk Density	87	pcf
Thickness	4	ft
Cover	0	psf
dded Stress	348	psf

Leachate Generation

Total change in void height	0.794	in
Landfill Area	2.93	acre
Total Leachate Volume	63,159	gal

Time Rate of Consolidation

Drainage Length: 12.5 ft
c(v): 0.02 ft^2/day

Avg. Degree of Consolidatio	Tv	Time (years)	Volume (gal)	Flowrate (gal/year)
1%	0.00008	0.002	632	368,847
10%	0.00785	0.168	6,316	37,590
20%	0.0314	0.672	12,632	18,795
30%	0.0707	1.513	18,948	12,521
40%	0.126	2.697	25,264	9,368
50%	0.197	4.217	31,579	7,489
60%	0.286	6.122	37,895	6,190
70%	0.403	8.626	44,211	5,125
80%	0.567	12.136	50,527	4,163
90%	0.848	18.151	56,843	3,132
99%	1.781	38.121	62,527	1,640

Lift	Time (weeks)	Time (years)	Tv	Avg. Degree of Consolidation	Volume (gal)	Flowrate (gal/year)
		0.001	4.67E-05	0.77%	487	487,125
2	2	0.038356	0.001792	4.78%	3,017	78,654
3	3	0.057534	0.002688	5.85%	3,695	64,221
4	4	0.076712	0.003584	6.76%	4,267	55,617
Cover	6	0.115068	0.005376	8.27%	5,225	45,411
		0.46	0.021491	16.54%	10,448	22,712
		0.96	0.044851	23.90%	15,093	15,722
		10	0.4672	74.41%	46,994	4,699
		40	1.8688	99.19%	62,650	1,566
		1.113	0.051999	25.73%	16,251	14,601

Secondary Consolidation Results

C(alpha)	0.018
Layer Thickness (ft)	25
Secondary Settlement (in)	5.4

Depth to Soil Layer Top (ft)	Bottom (ft)	Cc/(1+e)	Cr/(1+e)	sigma m' (lb/ft^2)	gamma (lb/ft^3)	zf (ft)	sigma c' (lb/ft^2)	sigma zo' (lb/ft^2)	delta sigma (lb/ft^2)	sigma zf' (lb/ft^2)	strain (%)	Settlement (in)	Change in Void Height (in)
0.0	0.0				87								
0.0	0.5	0.237		0	87	0.25	240	240	348	588	9.230	0.554	0.047
0.5	1.0	0.237		0	87	0.75	283	283	348	631	8.248	0.495	0.042
1.0	1.5	0.237		0	87	1.25	327	327	348	675	7.464	0.448	0.038
1.5	2.0	0.237		0	87	1.75	370	370	348	718	6.820	0.409	0.035
2.0	2.5	0.237		0	87	2.25	414	414	348	762	6.282	0.377	0.032
2.5	3.0	0.237		0	87	2.75	457	457	348	805	5.825	0.349	0.030
3.0	3.5	0.237		0	87	3.25	501	501	348	849	5.431	0.326	0.028
3.5	4.0	0.237		0	87	3.75	544	544	348	892	5.088	0.305	0.026
4.0	4.5	0.237		0	87	4.25	588	588	348	936	4.787	0.287	0.025
4.5	5.0	0.237		0	87	4.75	631	631	348	979	4.519	0.271	0.023
5.0	5.5	0.237		0	87	5.25	675	675	348	1023	4.281	0.257	0.022
5.5	6.0	0.237		0	87	5.75	718	718	348	1066	4.066	0.244	0.021
6.0	6.5	0.237		0	87	6.25	762	762	348	1110	3.873	0.232	0.020
6.5	7.0	0.237		0	87	6.75	805	805	348	1153	3.697	0.222	0.019
7.0	7.5	0.237		0	87	7.25	849	849	348	1197	3.536	0.212	0.018
7.5	8.0	0.237		0	87	7.75	892	892	348	1240	3.389	0.203	0.017
8.0	8.5	0.237		0	87	8.25	936	936	348	1284	3.254	0.195	0.017
8.5	9.0	0.237		0	87	8.75	979	979	348	1327	3.130	0.188	0.016
9.0	9.5	0.237		0	87	9.25	1023	1023	348	1371	3.014	0.181	0.015
9.5	10.0	0.237		0	87	9.75	1066	1066	348	1414	2.907	0.174	0.015
10.0	10.5	0.237		0	87	10.25	1110	1110	348	1458	2.807	0.168	0.014
10.5	11.0	0.237		0	87	10.75	1153	1153	348	1501	2.714	0.163	0.014
11.0	11.5	0.237		0	87	11.25	1197	1197	348	1545	2.627	0.158	0.013
11.5	12.0	0.237		0	87	11.75	1240	1240	348	1588	2.545	0.153	0.013
12.0	12.5	0.237		0	87	12.25	1284	1284	348	1632	2.468	0.148	0.013
12.5	13.0	0.237		0	87	12.75	1327	1327	348	1675	2.396	0.144	0.012
13.0	13.5	0.237		0	87	13.25	1371	1371	348	1719	2.328	0.140	0.012
13.5	14.0	0.237		0	87	13.75	1414	1414	348	1762	2.264	0.136	0.012
14.0	14.5	0.237		0	87	14.25	1458	1458	348	1806	2.203	0.132	0.011
14.5	15.0	0.237		0	87	14.75	1501	1501	348	1849	2.145	0.129	0.011
15.0	15.5	0.237		0	87	15.25	1545	1545	348	1893	2.090	0.125	0.011
15.5	16.0	0.237		0	87	15.75	1588	1588	348	1936	2.038	0.122	0.010
16.0	16.5	0.237		0	87	16.25	1632	1632	348	1980	1.989	0.119	0.010
16.5	17.0	0.237		0	87	16.75	1675	1675	348	2023	1.942	0.116	0.010
17.0	17.5	0.237		0	87	17.25	1719	1719	348	2067	1.897	0.114	0.010
17.5	18.0	0.237		0	87	17.75	1762	1762	348	2110	1.854	0.111	0.009
18.0	18.5	0.237		0	87	18.25	1806	1806	348	2153	1.813	0.109	0.009
18.5	19.0	0.237		0	87	18.75	1849	1849	348	2197	1.773	0.106	0.009
19.0	19.5	0.237		0	87	19.25	1893	1893	348	2240	1.736	0.104	0.009
19.5	20.0	0.237		0	87	19.75	1936	1936	348	2284	1.700	0.102	0.009
20.0	20.5	0.237		0	87	20.25	1980	1980	348	2327	1.665	0.100	0.009
20.5	21.0	0.237		0	87	20.75	2023	2023	348	2371	1.632	0.098	0.008
21.0	21.5	0.237		0	87	21.25	2067	2067	348	2414	1.600	0.096	0.008
21.5	22.0	0.237		0	87	21.75	2110	2110	348	2458	1.569	0.094	0.008
22.0	22.5	0.237		0	87	22.25	2154	2154	348	2501	1.540	0.092	0.008
22.5	23.0	0.237		0	87	22.75	2197	2197	347	2545	1.511	0.091	0.008
23.0	23.5	0.237		0	87	23.25	2241	2241	347	2588	1.484	0.089	0.008
23.5	24.0	0.237		0	87	23.75	2284	2284	347	2632	1.457	0.087	0.007
24.0	24.5	0.237		0	87	24.25	2328	2328	347	2675	1.432	0.086	0.007
24.5	25.0	0.237		0	87	24.75	2371	2371	347	2719	1.407	0.084	0.007
25.0	25.5			-2393		25.25		2393	347	2740	#NUM!	#NUM!	
25.5	26.0			-2393		25.75		2393	347	2740	#NUM!	#NUM!	
26.0	26.5			-2393		26.25		2393	347	2740	#NUM!	#NUM!	

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SETTLEMENT ANALYSIS OF SHALLOW FOUNDATIONS

Classical Method

Date: August 6, 2008
Identification: 12th St Landfill - Existing Residuals, Lift 3 (5-10')

Input

		Units	E or SI
Shape		sq	SQ, CI, CO, or RE
B =	280	ft	
L =	280	ft	
D =	0	ft	
P =		k	
Dw =	100	ft	
r =	1		

Overburden

	87 pcf
	5 ft
	131 psf
	566 psf

Existing Residuals

Void Ratio	2
Sat Density	87 pcf
w	0.83
Gs	2.23

Primary Settlement Results

Surcharge =	435 lb/ft^2
Primary Settlement =	7.61 in

Relocated Residuals

Bulk Density	87 pcf
Thickness	5 ft
Cover	0 psf
dded Stress	435 psf

Lift	Time (weeks)	Time (years)	Tv	Avg. Degree of Consolidation	Volume (gal)	Flowrate (gal/year)
		0.001	4.67E-05	0.77%	244	243,782
3	1	0.019178	0.000896	3.38%	1,068	55,667
4	2	0.038356	0.001792	4.78%	1,510	39,363
Cover	4	0.076712	0.003584	6.76%	2,135	27,834
		0.423	0.019763	15.86%	5,014	11,853
		0.923	0.043123	23.43%	7,406	8,024
		10	0.4672	74.41%	23,518	2,352
		40	1.8688	99.19%	31,353	784
		1.076	0.050271	25.30%	7,997	7,432

Leachate Generation

Total change in void height	0.650 in
Landfill Area	1.79 acre
Total Leachate Volume	31,608 gal

Time Rate of Consolidation

Drainage Length	12.5 ft
c(v)	0.02 ft^2/day

Avg. Degree of Consolidatio	Tv	Time (years)	Volume (gal)	Flowrate (gal/year)
1%	0.00008	0.002	316	184,590
10%	0.00785	0.168	3,161	18,812
20%	0.0314	0.672	6,322	9,406
30%	0.0707	1.513	9,482	6,266
40%	0.126	2.697	12,643	4,688
50%	0.197	4.217	15,804	3,748
60%	0.286	6.122	18,965	3,098
70%	0.403	8.626	22,126	2,565
80%	0.567	12.136	25,286	2,084
90%	0.848	18.151	28,447	1,567
99%	1.761	38.121	31,292	821

Secondary Consolidation Results

C(alpha)	0.018
Layer Thickness (ft)	25
Secondary Settlement (in)	5.4

Depth to Soil Layer Top (ft)	Bottom (ft)	Cc/(1+e)	Cr/(1+e)	sigma m' (lb/ft^2)	gamma (lb/ft^3)	zf (ft)	sigma c' (lb/ft^2)	sigma zo' (lb/ft^2)	delta sigma (lb/ft^2)	sigma zf' (lb/ft^2)	strain (%)	Settlement (in)	Change in Void Height (in)
0.0	0.0				87								
0.0	0.5	0.237		0	87	0.25	588	588	435	1023	5.702	0.342	0.029
0.5	1.0	0.237		0	87	0.75	631	631	435	1066	5.395	0.324	0.028
1.0	1.5	0.237		0	87	1.25	675	675	435	1110	5.121	0.307	0.026
1.5	2.0	0.237		0	87	1.75	718	718	435	1153	4.874	0.292	0.025
2.0	2.5	0.237		0	87	2.25	762	762	435	1197	4.650	0.279	0.024
2.5	3.0	0.237		0	87	2.75	805	805	435	1240	4.446	0.267	0.023
3.0	3.5	0.237		0	87	3.25	849	849	435	1284	4.259	0.256	0.022
3.5	4.0	0.237		0	87	3.75	892	892	435	1327	4.087	0.245	0.021
4.0	4.5	0.237		0	87	4.25	936	936	435	1371	3.929	0.236	0.020
4.5	5.0	0.237		0	87	4.75	979	979	435	1414	3.783	0.227	0.019
5.0	5.5	0.237		0	87	5.25	1023	1023	435	1458	3.648	0.219	0.019
5.5	6.0	0.237		0	87	5.75	1066	1066	435	1501	3.522	0.211	0.018
6.0	6.5	0.237		0	87	6.25	1110	1110	435	1545	3.404	0.204	0.017
6.5	7.0	0.237		0	87	6.75	1153	1153	435	1588	3.294	0.198	0.017
7.0	7.5	0.237		0	87	7.25	1197	1197	435	1632	3.191	0.191	0.016
7.5	8.0	0.237		0	87	7.75	1240	1240	435	1675	3.094	0.186	0.016
8.0	8.5	0.237		0	87	8.25	1284	1284	435	1719	3.003	0.180	0.015
8.5	9.0	0.237		0	87	8.75	1327	1327	435	1762	2.917	0.175	0.015
9.0	9.5	0.237		0	87	9.25	1371	1371	435	1806	2.836	0.170	0.015
9.5	10.0	0.237		0	87	9.75	1414	1414	435	1849	2.760	0.166	0.014
10.0	10.5	0.237		0	87	10.25	1458	1458	435	1893	2.687	0.161	0.014
10.5	11.0	0.237		0	87	10.75	1501	1501	435	1936	2.618	0.157	0.013
11.0	11.5	0.237		0	87	11.25	1545	1545	435	1980	2.553	0.153	0.013
11.5	12.0	0.237		0	87	11.75	1588	1588	435	2023	2.491	0.149	0.013
12.0	12.5	0.237		0	87	12.25	1632	1632	435	2067	2.431	0.146	0.012
12.5	13.0	0.237		0	87	12.75	1675	1675	435	2110	2.375	0.142	0.012
13.0	13.5	0.237		0	87	13.25	1719	1719	435	2153	2.321	0.139	0.012
13.5	14.0	0.237		0	87	13.75	1762	1762	435	2197	2.269	0.136	0.012
14.0	14.5	0.237		0	87	14.25	1806	1806	435	2240	2.220	0.133	0.011
14.5	15.0	0.237		0	87	14.75	1849	1849	435	2284	2.173	0.130	0.011
15.0	15.5	0.237		0	87	15.25	1893	1893	435	2327	2.127	0.128	0.011
15.5	16.0	0.237		0	87	15.75	1936	1936	435	2371	2.084	0.125	0.011
16.0	16.5	0.237		0	87	16.25	1980	1980	434	2414	2.042	0.123	0.010
16.5	17.0	0.237		0	87	16.75	2023	2023	434	2458	2.002	0.120	0.010
17.0	17.5	0.237		0	87	17.25	2067	2067	434	2501	1.964	0.118	0.010
17.5	18.0	0.237		0	87	17.75	2110	2110	434	2545	1.926	0.116	0.010
18.0	18.5	0.237		0	87	18.25	2154	2154	434	2588	1.891	0.113	0.010
18.5	19.0	0.237		0	87	18.75	2197	2197	434	2631	1.856	0.111	0.010
19.0	19.5	0.237		0	87	19.25	2241	2241	434	2675	1.823	0.109	0.009
19.5	20.0	0.237		0	87	19.75	2284	2284	434	2718	1.791	0.107	0.009
20.0	20.5	0.237		0	87	20.25	2328	2328	434	2762	1.760	0.106	0.009
20.5	21.0	0.237		0	87	20.75	2371	2371	434	2805	1.730	0.104	0.009
21.0	21.5	0.237		0	87	21.25	2415	2415	434	2849	1.701	0.102	0.009
21.5	22.0	0.237		0	87	21.75	2458	2458	434	2892	1.673	0.100	0.009
22.0	22.5	0.237		0	87	22.25	2502	2502	434	2935	1.646	0.099	0.008
22.5	23.0	0.237		0	87	22.75	2545	2545	434	2979	1.619	0.097	0.008
23.0	23.5	0.237		0	87	23.25	2589	2589	434	3022	1.594	0.096	0.008
23.5	24.0	0.237		0	87	23.75	2632	2632	433	3066	1.569	0.094	0.008
24.0	24.5	0.237		0	87	24.25	2676	2676	433	3109	1.545	0.093	0.008
24.5	25.0	0.237		0	87	24.75	2719	2719	433	3153	1.522	0.091	0.008
25.0	25.5			-2741		25.25		2741	433	3174	#NUM!	#NUM!	

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SETTLEMENT ANALYSIS OF SHALLOW FOUNDATIONS
Classical Method

Date: August 6, 2008
Identification: 12th St Landfill - Existing Residuals, Lift 4 (10-15')

Input

		Units	E or SI
Shape		sq	SQ, CI, CO, or RE
B =	210	ft	
L =	210	ft	
D =	0	ft	
P =		k	
Dw =	100	ft	
r =	1		

Existing Residuals

Void Ratio	2	
Sat Density	87	pcf
w	0.83	
Gs	2.23	

Primary Settlement Results

Surcharge =	435	lb/ft^2
Primary Settlement =	5.30	in

Overburden		
	87	pcf
	10	ft
	131	psf
	1001	psf

Relocated Residuals

Bulk Density	87	pcf
Thickness	5	ft
Cover	0	psf
dded Stress	435	psf

Lift	Time (weeks)	Time (years)	Tv	Avg. Degree of Consolidation	Volume (gal)	Flowrate (gal/year)
		0.001	4.67E-05	0.77%	92	91,953
4	1	0.019178	0.000896	3.38%	403	20,997
Cover	3	0.057534	0.002688	5.85%	697	12,123
		0.404	0.018875	15.50%	1,848	4,575
		0.904	0.042235	23.19%	2,765	3,058
		10	0.4672	74.41%	8,871	887
		40	1.8688	99.19%	11,826	296
		1.057	0.049383	25.08%	2,990	2,828

Leachate Generation

Total change in void height	0.453	in
Landfill Area	0.97	acre
Total Leachate Volume	11,922	gal

Time Rate of Consolidation

Drainage Length	12.5 ft
c(v)	0.02 ft^2/day

Avg. Degree of Consolidation	Tv	Time (years)	Volume (gal)	Flowrate (gal/year)
1%	0.00008	0.002	119	69,626
10%	0.00785	0.168	1,192	7,096
20%	0.0314	0.672	2,384	3,548
30%	0.0707	1.513	3,577	2,364
40%	0.126	2.697	4,769	1,768
50%	0.197	4.217	5,961	1,414
60%	0.286	6.122	7,153	1,169
70%	0.403	8.626	8,346	968
80%	0.567	12.136	9,538	786
90%	0.848	18.151	10,730	591
99%	1.781	38.121	11,803	310

Secondary Consolidation Results

C(alpha)	0.018
Layer Thickness (ft)	25
Secondary Settlement (in)	5.4

Depth to Soil Layer Top (ft)	Bottom (ft)	Cc/(1+e)	Cr/(1+e)	sigma m' (lb/ft^2)	gamma (lb/ft^3)	zf (ft)	sigma c' (lb/ft^2)	sigma zo' (lb/ft^2)	delta sigma (lb/ft^2)	sigma zf' (lb/ft^2)	strain (%)	Settlement (in)	Change in Void Height (in)
0.0	0.0				87								
0.0	0.5	0.237		0	87	0.25	1023	1023	435	1458	3.648	0.219	0.019
0.5	1.0	0.237		0	87	0.75	1066	1066	435	1501	3.522	0.211	0.018
1.0	1.5	0.237		0	87	1.25	1110	1110	435	1545	3.404	0.204	0.017
1.5	2.0	0.237		0	87	1.75	1153	1153	435	1588	3.294	0.198	0.017
2.0	2.5	0.237		0	87	2.25	1197	1197	435	1632	3.191	0.191	0.016
2.5	3.0	0.237		0	87	2.75	1240	1240	435	1675	3.094	0.186	0.016
3.0	3.5	0.237		0	87	3.25	1284	1284	435	1719	3.003	0.180	0.015
3.5	4.0	0.237		0	87	3.75	1327	1327	435	1762	2.918	0.175	0.015
4.0	4.5	0.237		0	87	4.25	1371	1371	435	1806	2.837	0.170	0.015
4.5	5.0	0.237		0	87	4.75	1414	1414	435	1849	2.760	0.166	0.014
5.0	5.5	0.237		0	87	5.25	1458	1458	435	1893	2.688	0.161	0.014
5.5	6.0	0.237		0	87	5.75	1501	1501	435	1936	2.619	0.157	0.013
6.0	6.5	0.237		0	87	6.25	1545	1545	435	1980	2.553	0.153	0.013
6.5	7.0	0.237		0	87	6.75	1588	1588	435	2023	2.491	0.149	0.013
7.0	7.5	0.237		0	87	7.25	1632	1632	435	2067	2.432	0.146	0.012
7.5	8.0	0.237		0	87	7.75	1675	1675	435	2110	2.375	0.143	0.012
8.0	8.5	0.237		0	87	8.25	1719	1719	435	2154	2.321	0.139	0.012
8.5	9.0	0.237		0	87	8.75	1762	1762	435	2197	2.270	0.136	0.012
9.0	9.5	0.237		0	87	9.25	1806	1806	435	2241	2.221	0.133	0.011
9.5	10.0	0.237		0	87	9.75	1849	1849	435	2284	2.173	0.130	0.011
10.0	10.5	0.237		0	87	10.25	1893	1893	435	2327	2.128	0.128	0.011
10.5	11.0	0.237		0	87	10.75	1936	1936	435	2371	2.084	0.125	0.011
11.0	11.5	0.237		0	87	11.25	1980	1980	435	2414	2.043	0.123	0.010
11.5	12.0	0.237		0	87	11.75	2023	2023	435	2458	2.003	0.120	0.010
12.0	12.5	0.237		0	87	12.25	2067	2067	434	2501	1.964	0.118	0.010
12.5	13.0	0.237		0	87	12.75	2110	2110	434	2545	1.927	0.116	0.010
13.0	13.5	0.237		0	87	13.25	2154	2154	434	2588	1.891	0.113	0.010
13.5	14.0	0.237		0	87	13.75	2197	2197	434	2632	1.856	0.111	0.010
14.0	14.5	0.237		0	87	14.25	2241	2241	434	2675	1.823	0.109	0.009
14.5	15.0	0.237		0	87	14.75	2284	2284	434	2718	1.791	0.107	0.009
15.0	15.5	0.237		0	87	15.25	2328	2328	434	2762	1.760	0.106	0.009
15.5	16.0	0.237		0	87	15.75	2371	2371	434	2805	1.730	0.104	0.009
16.0	16.5	0.237		0	87	16.25	2415	2415	434	2849	1.701	0.102	0.009
16.5	17.0	0.237		0	87	16.75	2458	2458	434	2892	1.672	0.100	0.009
17.0	17.5	0.237		0	87	17.25	2502	2502	434	2935	1.645	0.099	0.008
17.5	18.0	0.237		0	87	17.75	2545	2545	433	2979	1.619	0.097	0.008
18.0	18.5	0.237		0	87	18.25	2589	2589	433	3022	1.593	0.096	0.008
18.5	19.0	0.237		0	87	18.75	2632	2632	433	3065	1.568	0.094	0.008
19.0	19.5	0.237		0	87	19.25	2676	2676	433	3109	1.544	0.093	0.008
19.5	20.0	0.237		0	87	19.75	2719	2719	433	3152	1.521	0.091	0.008
20.0	20.5	0.237		0	87	20.25	2763	2763	433	3196	1.498	0.090	0.008
20.5	21.0	0.237		0	87	20.75	2806	2806	433	3239	1.476	0.089	0.008
21.0	21.5	0.237		0	87	21.25	2850	2850	432	3282	1.454	0.087	0.007
21.5	22.0	0.237		0	87	21.75	2893	2893	432	3326	1.433	0.086	0.007
22.0	22.5	0.237		0	87	22.25	2937	2937	432	3369	1.413	0.085	0.007
22.5	23.0	0.237		0	87	22.75	2980	2980	432	3412	1.393	0.084	0.007
23.0	23.5	0.237		0	87	23.25	3024	3024	432	3455	1.374	0.082	0.007
23.5	24.0	0.237		0	87	23.75	3067	3067	431	3499	1.355	0.081	0.007
24.0	24.5	0.237		0	87	24.25	3111	3111	431	3542	1.336	0.080	0.007
24.5	25.0	0.237		0	87	24.75	3154	3154	431	3585	1.318	0.079	0.007
25.0	25.5			-3176		25.25		3176	431	3607	#NUM!	#NUM!	
25.5	26.0			-3176		25.75		3176	431	3607	#NUM!	#NUM!	

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SETTLEMENT ANALYSIS OF SHALLOW FOUNDATIONS
Classical Method

Date: August 6, 2008
Identification: 12th St Landfill - Existing Residuals, Lift 5 (15-20')

Input

Units: E E or SI
Shape: sq SQ, CI, CO, or RE

B =	130	ft	
L =	130	ft	
D =	0	ft	*Overburden*
P =	k		87 pcf
Dw =	100	ft	15 ft
r =	1		131 psf
			1436 psf

Existing Residuals

Void Ratio	2	
Sat Density	87	pcf
w	0.83	
Gs	2.23	

Primary Settlement Results

Surcharge = 435 lb/ft^2
Primary Settlement = 3.73 in

Relocated Residuals

Bulk Density	87	pcf
Thickness	5	ft
Cover	0	psf
dded Stress	435	psf

Lift	Time (weeks)	Time (years)	Tv	Avg. Degree of Consolidation	Volume (gal)	Flowrate (gal/year)
		0.001	4.67E-05	0.77%	26	25,998
Cover	2	0.038356	0.001792	4.78%	161	4,198
		0.385	0.017987	15.13%	510	1,325
		0.885	0.041347	22.94%	773	874
		10	0.4672	74.41%	2,508	251
		40	1.8688	99.19%	3,344	84
		1.038	0.048495	24.85%	838	807

Leachate Generation

Total change in void height	0.318	in
Landfill Area	0.39	acre
Total Leachate Volume	3,371	gal

Time Rate of Consolidation

Drainage Length: 12.5 ft
c(v): 0.02 ft^2/day

Avg. Degree of Consolidation	Tv	Time (years)	Volume (gal)	Flowrate (gal/year)
1%	0.00008	0.002	34	19,686
10%	0.00785	0.168	337	2,006
20%	0.0314	0.672	674	1,003
30%	0.0707	1.513	1,011	668
40%	0.126	2.697	1,348	500
50%	0.197	4.217	1,685	400
60%	0.286	6.122	2,023	330
70%	0.403	8.626	2,360	274
80%	0.567	12.136	2,697	222
90%	0.848	18.151	3,034	167
99%	1.781	38.121	3,337	88

Secondary Consolidation Results

C(alpha)	0.018
Layer Thickness (ft)	25
Secondary Settlement (in)	5.4

Depth to Soil Layer Top (ft)	Bottom (ft)	Cc/(1+e)	Cr/(1+e)	sigma m' (lb/ft^2)	gamma (lb/ft^3)	zf (ft)	sigma c' (lb/ft^2)	sigma zo' (lb/ft^2)	delta sigma (lb/ft^2)	sigma zf' (lb/ft^2)	strain (%)	Settlement (in)	Change in Void Height (in)
0.0	0.0				87								
0.0	0.5	0.237		0	87	0.25	1458	1458	435	1893	2.688	0.161	0.014
0.5	1.0	0.237		0	87	0.75	1501	1501	435	1936	2.619	0.157	0.013
1.0	1.5	0.237		0	87	1.25	1545	1545	435	1980	2.554	0.153	0.013
1.5	2.0	0.237		0	87	1.75	1588	1588	435	2023	2.492	0.149	0.013
2.0	2.5	0.237		0	87	2.25	1632	1632	435	2067	2.432	0.146	0.012
2.5	3.0	0.237		0	87	2.75	1675	1675	435	2110	2.376	0.143	0.012
3.0	3.5	0.237		0	87	3.25	1719	1719	435	2154	2.322	0.139	0.012
3.5	4.0	0.237		0	87	3.75	1762	1762	435	2197	2.270	0.136	0.012
4.0	4.5	0.237		0	87	4.25	1806	1806	435	2241	2.221	0.133	0.011
4.5	5.0	0.237		0	87	4.75	1849	1849	435	2284	2.174	0.130	0.011
5.0	5.5	0.237		0	87	5.25	1893	1893	435	2328	2.129	0.128	0.011
5.5	6.0	0.237		0	87	5.75	1936	1936	435	2371	2.085	0.125	0.011
6.0	6.5	0.237		0	87	6.25	1980	1980	435	2414	2.043	0.123	0.010
6.5	7.0	0.237		0	87	6.75	2023	2023	435	2458	2.003	0.120	0.010
7.0	7.5	0.237		0	87	7.25	2067	2067	435	2501	1.964	0.118	0.010
7.5	8.0	0.237		0	87	7.75	2110	2110	434	2545	1.927	0.116	0.010
8.0	8.5	0.237		0	87	8.25	2154	2154	434	2588	1.891	0.113	0.010
8.5	9.0	0.237		0	87	8.75	2197	2197	434	2631	1.856	0.111	0.010
9.0	9.5	0.237		0	87	9.25	2241	2241	434	2675	1.823	0.109	0.009
9.5	10.0	0.237		0	87	9.75	2284	2284	434	2718	1.790	0.107	0.009
10.0	10.5	0.237		0	87	10.25	2328	2328	434	2762	1.759	0.106	0.009
10.5	11.0	0.237		0	87	10.75	2371	2371	434	2805	1.728	0.104	0.009
11.0	11.5	0.237		0	87	11.25	2415	2415	433	2848	1.699	0.102	0.009
11.5	12.0	0.237		0	87	11.75	2458	2458	433	2891	1.670	0.100	0.009
12.0	12.5	0.237		0	87	12.25	2502	2502	433	2935	1.643	0.099	0.008
12.5	13.0	0.237		0	87	12.75	2545	2545	433	2978	1.616	0.097	0.008
13.0	13.5	0.237		0	87	13.25	2589	2589	432	3021	1.590	0.095	0.008
13.5	14.0	0.237		0	87	13.75	2632	2632	432	3064	1.564	0.094	0.008
14.0	14.5	0.237		0	87	14.25	2676	2676	432	3108	1.540	0.092	0.008
14.5	15.0	0.237		0	87	14.75	2719	2719	431	3151	1.516	0.091	0.008
15.0	15.5	0.237		0	87	15.25	2763	2763	431	3194	1.492	0.090	0.008
15.5	16.0	0.237		0	87	15.75	2806	2806	431	3237	1.470	0.088	0.008
16.0	16.5	0.237		0	87	16.25	2850	2850	430	3280	1.447	0.087	0.007
16.5	17.0	0.237		0	87	16.75	2893	2893	430	3323	1.426	0.086	0.007
17.0	17.5	0.237		0	87	17.25	2937	2937	429	3366	1.405	0.084	0.007
17.5	18.0	0.237		0	87	17.75	2980	2980	429	3409	1.384	0.083	0.007
18.0	18.5	0.237		0	87	18.25	3024	3024	428	3452	1.364	0.082	0.007
18.5	19.0	0.237		0	87	18.75	3067	3067	428	3495	1.344	0.081	0.007
19.0	19.5	0.237		0	87	19.25	3111	3111	427	3538	1.325	0.080	0.007
19.5	20.0	0.237		0	87	19.75	3154	3154	427	3581	1.306	0.078	0.007
20.0	20.5	0.237		0	87	20.25	3198	3198	426	3624	1.288	0.077	0.007
20.5	21.0	0.237		0	87	20.75	3241	3241	426	3667	1.270	0.076	0.007
21.0	21.5	0.237		0	87	21.25	3285	3285	425	3710	1.252	0.075	0.006
21.5	22.0	0.237		0	87	21.75	3328	3328	424	3753	1.235	0.074	0.006
22.0	22.5	0.237		0	87	22.25	3372	3372	424	3795	1.218	0.073	0.006
22.5	23.0	0.237		0	87	22.75	3415	3415	423	3838	1.202	0.072	0.006
23.0	23.5	0.237		0	87	23.25	3459	3459	422	3881	1.186	0.071	0.006
23.5	24.0	0.237		0	87	23.75	3502	3502	421	3924	1.170	0.070	0.006
24.0	24.5	0.237		0	87	24.25	3546	3546	421	3966	1.154	0.069	0.006
24.5	25.0	0.237		0	87	24.75	3589	3589	420	4009	1.139	0.068	0.006
25.0	25.5			-3611		25.25		3611	419	4030	#NUMI	#NUMI	

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SETTLEMENT ANALYSIS OF SHALLOW FOUNDATIONS
Classical Method

Date: August 6, 2008
Identification: 12th St Landfill - Existing Residuals, Cover (3' thick)

Input

		Units	E or SI
Shape		sq	SQ, CI, CO, or RE
B =	285	ft	
L =	285	ft	
D =	0	ft	
P =		k	
Dw =	100	ft	
r =	1		

Overburden

	87	pcf
	20	ft
	131	psf
	1871	psf

Existing Residuals

Void Ratio	2	
Sat Density	87	pcf
w	0.83	
Gs	2.23	

Primary Settlement Results

Surcharge =	393	lb/ft^2
Primary Settlement =	1.93	in

Relocated Residuals

Cover Soil	131	pcf
Thickness	3	ft
	0	psf
dded Stress	393	psf

Time (years)	Tv	Avg. Degree of Consolidation	Volume (gal)	Flowrate (gal/year)
0.001	4.67E-05	0.77%	64	63,686
0.3466	0.016193	14.36%	1,186	3,421
0.8466	0.039553	22.44%	1,853	2,189
10	0.4672	74.41%	6,144	614
40	1.8688	99.19%	8,191	205
0.9996	0.046701	24.38%	2,014	2,014

Leachate Generation

Total change in void height	0.165	in
Landfill Area	1.84	acre
Total Leachate Volume	8,257	gal

Time Rate of Consolidation

Drainage Length	12.5	ft
c(v)	0.02	ft^2/day

Avg. Degree of Consolidation	Tv	Time (years)	Volume (gal)	Flowrate (gal/year)
1%	0.00008	0.002	83	48,222
10%	0.00785	0.168	826	4,914
20%	0.0314	0.672	1,651	2,457
30%	0.0707	1.513	2,477	1,637
40%	0.126	2.697	3,303	1,225
50%	0.197	4.217	4,129	979
60%	0.286	6.122	4,954	809
70%	0.403	8.626	5,780	670
80%	0.567	12.136	6,606	544
90%	0.848	18.151	7,432	409
99%	1.781	38.121	8,175	214

Secondary Consolidation Results

C(alpha)	0.018
Layer Thickness (ft)	25
Secondary Settlement (in)	5.4

Depth to Soil Layer Top (ft)	Bottom (ft)	Cc/(1+e)	Cr/(1+e)	sigma m' (lb/ft^2)	gamma (lb/ft^3)	zf (ft)	sigma c' (lb/ft^2)	sigma zo' (lb/ft^2)	delta sigma (lb/ft^2)	sigma zf' (lb/ft^2)	strain (%)	Settlement (in)	Change in Void Height (in)
0.0	0.0				87								
0.0	0.5	0.237		0	87	0.25	1893	1893	393	2286	1.942	0.117	0.010
0.5	1.0	0.237		0	87	0.75	1936	1936	393	2329	1.902	0.114	0.010
1.0	1.5	0.237		0	87	1.25	1980	1980	393	2373	1.864	0.112	0.010
1.5	2.0	0.237		0	87	1.75	2023	2023	393	2416	1.827	0.110	0.009
2.0	2.5	0.237		0	87	2.25	2067	2067	393	2460	1.792	0.108	0.009
2.5	3.0	0.237		0	87	2.75	2110	2110	393	2503	1.758	0.105	0.009
3.0	3.5	0.237		0	87	3.25	2154	2154	393	2547	1.725	0.104	0.009
3.5	4.0	0.237		0	87	3.75	2197	2197	393	2590	1.694	0.102	0.009
4.0	4.5	0.237		0	87	4.25	2241	2241	393	2634	1.663	0.100	0.009
4.5	5.0	0.237		0	87	4.75	2284	2284	393	2677	1.634	0.098	0.008
5.0	5.5	0.237		0	87	5.25	2328	2328	393	2721	1.606	0.096	0.008
5.5	6.0	0.237		0	87	5.75	2371	2371	393	2764	1.578	0.095	0.008
6.0	6.5	0.237		0	87	6.25	2415	2415	393	2808	1.552	0.093	0.008
6.5	7.0	0.237		0	87	6.75	2458	2458	393	2851	1.526	0.092	0.008
7.0	7.5	0.237		0	87	7.25	2502	2502	393	2895	1.502	0.090	0.008
7.5	8.0	0.237		0	87	7.75	2545	2545	393	2938	1.478	0.089	0.008
8.0	8.5	0.237		0	87	8.25	2589	2589	393	2982	1.455	0.087	0.007
8.5	9.0	0.237		0	87	8.75	2632	2632	393	3025	1.432	0.086	0.007
9.0	9.5	0.237		0	87	9.25	2676	2676	393	3069	1.410	0.085	0.007
9.5	10.0	0.237		0	87	9.75	2719	2719	393	3112	1.389	0.083	0.007
10.0	10.5	0.237		0	87	10.25	2763	2763	393	3156	1.369	0.082	0.007
10.5	11.0	0.237		0	87	10.75	2806	2806	393	3199	1.349	0.081	0.007
11.0	11.5	0.237		0	87	11.25	2850	2850	393	3243	1.329	0.080	0.007
11.5	12.0	0.237		0	87	11.75	2893	2893	393	3286	1.310	0.079	0.007
12.0	12.5	0.237		0	87	12.25	2937	2937	393	3330	1.292	0.078	0.007
12.5	13.0	0.237		0	87	12.75	2980	2980	393	3373	1.274	0.076	0.007
13.0	13.5	0.237		0	87	13.25	3024	3024	393	3417	1.257	0.075	0.006
13.5	14.0	0.237		0	87	13.75	3067	3067	393	3460	1.240	0.074	0.006
14.0	14.5	0.237		0	87	14.25	3111	3111	393	3503	1.224	0.073	0.006
14.5	15.0	0.237		0	87	14.75	3154	3154	393	3547	1.208	0.072	0.006
15.0	15.5	0.237		0	87	15.25	3198	3198	393	3590	1.192	0.072	0.006
15.5	16.0	0.237		0	87	15.75	3241	3241	393	3634	1.177	0.071	0.006
16.0	16.5	0.237		0	87	16.25	3285	3285	393	3677	1.162	0.070	0.006
16.5	17.0	0.237		0	87	16.75	3328	3328	393	3721	1.148	0.069	0.006
17.0	17.5	0.237		0	87	17.25	3372	3372	392	3764	1.133	0.068	0.006
17.5	18.0	0.237		0	87	17.75	3415	3415	392	3808	1.120	0.067	0.006
18.0	18.5	0.237		0	87	18.25	3459	3459	392	3851	1.106	0.066	0.006
18.5	19.0	0.237		0	87	18.75	3502	3502	392	3895	1.093	0.066	0.006
19.0	19.5	0.237		0	87	19.25	3546	3546	392	3938	1.080	0.065	0.006
19.5	20.0	0.237		0	87	19.75	3589	3589	392	3981	1.067	0.064	0.005
20.0	20.5	0.237		0	87	20.25	3633	3633	392	4025	1.055	0.063	0.005
20.5	21.0	0.237		0	87	20.75	3676	3676	392	4068	1.043	0.063	0.005
21.0	21.5	0.237		0	87	21.25	3720	3720	392	4112	1.031	0.062	0.005
21.5	22.0	0.237		0	87	21.75	3763	3763	392	4155	1.020	0.061	0.005
22.0	22.5	0.237		0	87	22.25	3807	3807	392	4199	1.009	0.061	0.005
22.5	23.0	0.237		0	87	22.75	3850	3850	392	4242	0.998	0.060	0.005
23.0	23.5	0.237		0	87	23.25	3894	3894	392	4286	0.987	0.059	0.005
23.5	24.0	0.237		0	87	23.75	3937	3937	392	4329	0.976	0.059	0.005
24.0	24.5	0.237		0	87	24.25	3981	3981	392	4372	0.966	0.058	0.005
24.5	25.0	0.237		0	87	24.75	4024	4024	392	4416	0.956	0.057	0.005
25.0	25.5			-4046		25.25		4046	391	4437	#NUM!	#NUM!	
25.5	26.0			-4046		25.75		4046	391	4437	#NUM!	#NUM!	

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SETTLEMENT ANALYSIS OF SHALLOW FOUNDATIONS

Classical Method

Date: August 6, 2008

Identification: 12th St Landfill - Relocated Residuals Lift 2 (1-5') accounts for only

Existing Residuals

Void Ratio	2
Sat Density	87 pcf
w	0.83
Gs	2.23

Leachate Generation

Total change in void height	0.247 in
Landfill Area	2.93 acre
Total Leachate Volume	19,636 gal

Time Rate of Consolidation

Initial Drainage Length	2.5 ft
c(v)	0.02 ft^2/day

Input

	Units
Shape	sq
B =	360 ft
L =	360 ft
D =	0 ft
P =	k
Dw =	100 ft
r =	1

E E or SI

SQ, CI, CO, or RE

Primary Settlement Results

Surcharge =	348 lb/ft^2
Total Settlement =	2.89 in

Overburden

	87 pcf
	0 ft
	0 psf
	0 psf

Relocated Residuals

lk Density	87 pcf
Thickness	4 ft
Cover	0 psf
ed Stress	348 psf

Avg. Degree of Consolidation	Tv	Time (years)	Volume (gal)	Flowrate (gal/year)
1%	0.00008	0.000	196	2,866,928
10%	0.00785	0.007	1,964	292,171
20%	0.0314	0.027	3,927	146,086
30%	0.0707	0.061	5,891	97,321
40%	0.126	0.108	7,855	72,811
50%	0.197	0.169	9,818	58,212
60%	0.286	0.245	11,782	48,116
70%	0.403	0.345	13,746	39,838
80%	0.567	0.485	15,709	32,360
90%	0.848	0.726	17,673	24,342
99%	1.781	1.525	19,440	12,749

Secondary Consolidation Results

C(alpha)	0.018
Layer Thickness (ft)	1
Secondary Settlement (in)	0.216

Lift	Drainage Length (ft)	Time (weeks)	Time (years)	Tv	Avg. Degree of Consolidation	Volume (gal)	Flowrate (gal/year)
	2.5		0.001	0.001168	3.86%	757	757,252
2	5	2	0.038356	0.0112	11.94%	2,345	61,135
3	7.5	3	0.057534	0.007467	9.75%	1,915	33,278
4	10	4	0.076712	0.0056	8.44%	1,658	21,615
Cover	10	6	0.115068	0.0084	10.34%	2,031	17,648
	10		0.46	0.03358	20.68%	4,060	8,827
	10		0.96	0.07008	29.87%	5,866	6,110
	10		10	0.73	86.62%	17,009	1,701
	10		40	2.92	99.94%	19,625	491
	10		1.113	0.081249	32.16%	6,316	5,675

Depth to Soil Layer Top (ft)	Bottom (ft)	Cc/(1+e)	Cr/(1+e)	sigma m' (lb/ft^2)	gamma (lb/ft^3)	zf (ft)	sigma c' (lb/ft^2)	sigma zo' (lb/ft^2)	delta sigma (lb/ft^2)	sigma zf' (lb/ft^2)	strain (%)	Settlement (in)	Change in Void Height (in)
0.0	0.0				87								
0.0	0.5	0.237		0	87	0.25	22	22	348	370	29.162	1.750	0.149
0.5	1.0	0.237		0	87	0.75	65	65	348	413	18.999	1.140	0.097
1.0	1.5			-87		1.25		87	348	435	#NUMI	#NUMI	#NUMI
1.5	2.0			-87		1.75		87	348	435	#NUMI	#NUMI	#NUMI
2.0	2.5			-87		2.25		87	348	435	#NUMI	#NUMI	#NUMI
2.5	3.0			-87		2.75		87	348	435	#NUMI	#NUMI	#NUMI
3.0	3.5			-87		3.25		87	348	435	#NUMI	#NUMI	#NUMI
3.5	4.0			-87		3.75		87	348	435	#NUMI	#NUMI	#NUMI
4.0	4.5			-87		4.25		87	348	435	#NUMI	#NUMI	#NUMI
4.5	5.0			-87		4.75		87	348	435	#NUMI	#NUMI	#NUMI
5.0	5.5			-87		5.25		87	348	435	#NUMI	#NUMI	#NUMI
5.5	6.0			-87		5.75		87	348	435	#NUMI	#NUMI	#NUMI
6.0	6.5			-87		6.25		87	348	435	#NUMI	#NUMI	#NUMI
6.5	7.0			-87		6.75		87	348	435	#NUMI	#NUMI	#NUMI
7.0	7.5			-87		7.25		87	348	435	#NUMI	#NUMI	#NUMI
7.5	8.0			-87		7.75		87	348	435	#NUMI	#NUMI	#NUMI
8.0	8.5			-87		8.25		87	348	435	#NUMI	#NUMI	#NUMI
8.5	9.0			-87		8.75		87	348	435	#NUMI	#NUMI	#NUMI
9.0	9.5			-87		9.25		87	348	435	#NUMI	#NUMI	#NUMI
9.5	10.0			-87		9.75		87	348	435	#NUMI	#NUMI	#NUMI
10.0	10.5			-87		10.25		87	348	435	#NUMI	#NUMI	#NUMI
10.5	11.0			-87		10.75		87	348	435	#NUMI	#NUMI	#NUMI
11.0	11.5			-87		11.25		87	348	435	#NUMI	#NUMI	#NUMI
11.5	12.0			-87		11.75		87	348	435	#NUMI	#NUMI	#NUMI
12.0	12.5			-87		12.25		87	348	435	#NUMI	#NUMI	#NUMI
12.5	13.0			-87		12.75		87	348	435	#NUMI	#NUMI	#NUMI
13.0	13.5			-87		13.25		87	348	435	#NUMI	#NUMI	#NUMI
13.5	14.0			-87		13.75		87	348	435	#NUMI	#NUMI	#NUMI
14.0	14.5			-87		14.25		87	348	435	#NUMI	#NUMI	#NUMI
14.5	15.0			-87		14.75		87	348	435	#NUMI	#NUMI	#NUMI
15.0	15.5			-87		15.25		87	348	435	#NUMI	#NUMI	#NUMI
15.5	16.0			-87		15.75		87	348	435	#NUMI	#NUMI	#NUMI
16.0	16.5			-87		16.25		87	348	435	#NUMI	#NUMI	#NUMI
16.5	17.0			-87		16.75		87	348	435	#NUMI	#NUMI	#NUMI
17.0	17.5			-87		17.25		87	348	435	#NUMI	#NUMI	#NUMI
17.5	18.0			-87		17.75		87	348	435	#NUMI	#NUMI	#NUMI

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SETTLEMENT ANALYSIS OF SHALLOW FOUNDATIONS

Classical Method

Date: August 6, 2008

Identification: 12th St Landfill - Relocated Residuals Lift 3 (5-10')

Existing Residuals

Void Ratio	2
Sat Density	87 pcf
w	0.83
Gs	2.23

Leachate Generation

Total change in void height	0.684 in
Landfill Area	1.79 acre
Total Leachate Volume	33,237 gal

Input

	Units	E E or SI
Shape	sq	SQ, CI, CO, or RE
B =	280	ft
L =	280	ft
D =	0	ft
P =	k	
Dw =	100	ft
r =	1	

Primary Settlement Results

Surcharge =	435 lb/ft^2
Total Settlement =	8.01 in

Overburden

	87 pcf
	0 ft
	0 psf
	0 psf

Relocated Residuals

lk Density	87 pcf
Thickness	5 ft
Cover	0 psf
ed Stress	435 psf

Time Rate of Consolidation

Initial Drainage Length	5 ft
c(v)	0.02 ft^2/day

Avg. Degree of Consolidatio	Tv	Time (years)	Volume (gal)	Flowrate (gal/year)
1%	0.00008	0.000	332	1,213,160
10%	0.00785	0.027	3,324	123,634
20%	0.0314	0.108	6,647	61,817
30%	0.0707	0.242	9,971	41,182
40%	0.126	0.432	13,295	30,810
50%	0.197	0.675	16,619	24,633
60%	0.286	0.979	19,942	20,361
70%	0.403	1.380	23,266	16,858
80%	0.567	1.942	26,590	13,694
90%	0.848	2.904	29,914	10,300
99%	1.781	6.099	32,905	5,395

Lift	Drainage Length (ft)	Time (weeks)	Time (years)	Tv	Avg. Degree of Consolidation	Volume (gal)	Flowrate (gal/year)
	5		0.001	0.000292	1.93%	641	640,873
3	7.5	1	0.019178	0.002489	5.63%	1,871	97,561
4	10	2	0.038356	0.0028	5.97%	1,985	51,740
Cover	10	4	0.076712	0.0056	8.44%	2,807	36,586
	10		0.423	0.030879	19.83%	6,590	15,580
	10		0.923	0.067379	29.29%	9,735	10,547
	10		10	0.73	86.62%	28,790	2,879
	10		40	2.92	99.94%	33,217	830
	10		1.076	0.078548	31.62%	10,511	9,769

Secondary Consolidation Results

C(alpha)	0.018
Layer Thickness (ft)	5
Secondary Settlement (in)	1.08

Depth to Soil Layer Top (ft)	Bottom (ft)	Cc/(1+e)	Cr/(1+e)	sigma m' (lb/ft^2)	gamma (lb/ft^3)	zf (ft)	sigma c' (lb/ft^2)	sigma zo' (lb/ft^2)	delta sigma (lb/ft^2)	sigma zf' (lb/ft^2)	strain (%)	Settlement (in)	Change in Void Height (in)
0.0	0.0				87								
0.0	0.5	0.237		0	87	0.25	22	22	435	457	31.337	1.880	0.161
0.5	1.0	0.237		0	87	0.75	65	65	435	500	20.965	1.258	0.107
1.0	1.5	0.237		0	87	1.25	109	109	435	544	16.566	0.994	0.085
1.5	2.0	0.237		0	87	1.75	152	152	435	587	13.894	0.834	0.071
2.0	2.5	0.237		0	87	2.25	196	196	435	631	12.043	0.723	0.062
2.5	3.0	0.237		0	87	2.75	239	239	435	674	10.664	0.640	0.055
3.0	3.5	0.237		0	87	3.25	283	283	435	718	9.588	0.575	0.049
3.5	4.0	0.237		0	87	3.75	326	326	435	761	8.721	0.523	0.045
4.0	4.5	0.237		0	87	4.25	370	370	435	805	8.005	0.480	0.041
4.5	5.0	0.237		0	87	4.75	413	413	435	848	7.402	0.444	0.038
5.0	5.5			-435		5.25		435	435	870	#NUM!	#NUM!	#NUM!
5.5	6.0			-435		5.75		435	435	870	#NUM!	#NUM!	#NUM!
6.0	6.5			-435		6.25		435	435	870	#NUM!	#NUM!	#NUM!
6.5	7.0			-435		6.75		435	435	870	#NUM!	#NUM!	#NUM!
7.0	7.5			-435		7.25		435	435	870	#NUM!	#NUM!	#NUM!
7.5	8.0			-435		7.75		435	435	870	#NUM!	#NUM!	#NUM!
8.0	8.5			-435		8.25		435	435	870	#NUM!	#NUM!	#NUM!
8.5	9.0			-435		8.75		435	435	870	#NUM!	#NUM!	#NUM!
9.0	9.5			-435		9.25		435	435	870	#NUM!	#NUM!	#NUM!
9.5	10.0			-435		9.75		435	435	870	#NUM!	#NUM!	#NUM!
10.0	10.5			-435		10.25		435	435	870	#NUM!	#NUM!	#NUM!
10.5	11.0			-435		10.75		435	435	870	#NUM!	#NUM!	#NUM!
11.0	11.5			-435		11.25		435	435	870	#NUM!	#NUM!	#NUM!
11.5	12.0			-435		11.75		435	435	870	#NUM!	#NUM!	#NUM!
12.0	12.5			-435		12.25		435	435	870	#NUM!	#NUM!	#NUM!

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SETTLEMENT ANALYSIS OF SHALLOW FOUNDATIONS
Classical Method

Date: August 6, 2008
Identification: 12th St Landfill - Relocated Residuals Lift 4 (10-15')

Input

	Units	E E or SI
	Shape	sq SQ, CI, CO, or RE
B =		210 ft
L =		210 ft
D =		0 ft
P =		k
Dw =		100 ft
r =		1

Existing Residuals

Void Ratio	2	
Sat Density	87	pcf
w	0.83	
Gs	2.23	

Primary Settlement Results

Surcharge =	435	lb/ft^2
Total Settlement =	10.85	in

Overburden

	87	pcf
	0	ft
	0	psf
	0	psf

Relocated Residuals

lk Density	87	pcf
Thickness	5	ft
Cover	0	psf
ed Stress	435	psf

Leachate Generation

Total change in void height	0.927	in
Landfill Area	0.97	acre
Total Leachate Volume	24,406	gal

Time Rate of Consolidation

Initial Drainage Length: 7.5 ft
c(v): 0.02 ft^2/day

Avg. Degree of Consolidation	Tv	Time (years)	Volume (gal)	Flowrate (gal/year)
1%	0.00008	0.001	244	395,918
10%	0.00785	0.060	2,441	40,348
20%	0.0314	0.242	4,881	20,174
30%	0.0707	0.545	7,322	13,440
40%	0.126	0.971	9,762	10,055
50%	0.197	1.518	12,203	8,039
60%	0.286	2.204	14,644	6,645
70%	0.403	3.105	17,084	5,502
80%	0.567	4.369	19,525	4,469
90%	0.848	6.534	21,965	3,362
99%	1.781	13.723	24,162	1,761

Lift	Drainage Length (ft)	Time (weeks)	Time (years)	Tv	Avg. Degree of Consolidation	Volume (gal)	Flowrate (gal/year)
	7.5		0.001	0.00013	1.29%	314	313,726
4	10	1	0.019178	0.0014	4.22%	1,030	53,729
Cover	10	3	0.057534	0.0042	7.31%	1,785	31,020
	10		0.404	0.029492	19.38%	4,729	11,706
	10		0.904	0.065992	28.99%	7,075	7,826
	10		10	0.73	86.62%	21,140	2,114
	10		40	2.92	99.94%	24,391	610
	10		1.057	0.077161	31.34%	7,650	7,237

Secondary Consolidation Results

C(alpha)	0.018
Layer Thickness (ft)	10
Secondary Settlement (in)	2.16

Depth to Soil Layer Top (ft)	Bottom (ft)	Cc/(1+e)	Cr/(1+e)	sigma m' (lb/ft^2)	gamma (lb/ft^3)	zf (ft)	sigma c' (lb/ft^2)	sigma zo' (lb/ft^2)	delta sigma (lb/ft^2)	sigma zf' (lb/ft^2)	strain (%)	Settlement (in)	Change in Void Height (in)
0.0	0.0				87								
0.0	0.5	0.237		0	87	0.25	22	22	435	457	31.337	1.880	0.161
0.5	1.0	0.237		0	87	0.75	65	65	435	500	20.965	1.258	0.107
1.0	1.5	0.237		0	87	1.25	109	109	435	544	16.566	0.994	0.085
1.5	2.0	0.237		0	87	1.75	152	152	435	587	13.894	0.834	0.071
2.0	2.5	0.237		0	87	2.25	196	196	435	631	12.043	0.723	0.062
2.5	3.0	0.237		0	87	2.75	239	239	435	674	10.664	0.640	0.055
3.0	3.5	0.237		0	87	3.25	283	283	435	718	9.588	0.575	0.049
3.5	4.0	0.237		0	87	3.75	326	326	435	761	8.721	0.523	0.045
4.0	4.5	0.237		0	87	4.25	370	370	435	805	8.004	0.480	0.041
4.5	5.0	0.237		0	87	4.75	413	413	435	848	7.401	0.444	0.038
5.0	5.5	0.237		0	87	5.25	457	457	435	892	6.886	0.413	0.035
5.5	6.0	0.237		0	87	5.75	500	500	435	935	6.440	0.386	0.033
6.0	6.5	0.237		0	87	6.25	544	544	435	979	6.049	0.363	0.031
6.5	7.0	0.237		0	87	6.75	587	587	435	1022	5.705	0.342	0.029
7.0	7.5	0.237		0	87	7.25	631	631	435	1066	5.398	0.324	0.028
7.5	8.0	0.237		0	87	7.75	674	674	435	1109	5.123	0.307	0.026
8.0	8.5	0.237		0	87	8.25	718	718	435	1153	4.875	0.293	0.025
8.5	9.0	0.237		0	87	8.75	761	761	435	1196	4.651	0.279	0.024
9.0	9.5	0.237		0	87	9.25	805	805	435	1240	4.446	0.267	0.023
9.5	10.0	0.237		0	87	9.75	848	848	435	1283	4.259	0.256	0.022
10.0	10.5			-870		10.25		870	435	1305	#NUM!	#NUM!	#NUM!
10.5	11.0			-870		10.75		870	435	1305	#NUM!	#NUM!	#NUM!
11.0	11.5			-870		11.25		870	435	1305	#NUM!	#NUM!	#NUM!
11.5	12.0			-870		11.75		870	435	1305	#NUM!	#NUM!	#NUM!
12.0	12.5			-870		12.25		870	434	1304	#NUM!	#NUM!	#NUM!
12.5	13.0			-870		12.75		870	434	1304	#NUM!	#NUM!	#NUM!

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SETTLEMENT ANALYSIS OF SHALLOW FOUNDATIONS
Classical Method

Date: August 6, 2008
Identification: 12th St Landfill - Relocated Residuals Lift 5 (15-20')

Input

	Units		E or SI
	Shape	sq	SQ, CI, CO, or RE
B =		130	ft
L =		130	ft
D =		0	ft
P =		k	
Dw =		100	ft
r =		1	

Existing Residuals

Void Ratio	2	
Sat Density	87	pcf
w	0.83	
Gs	2.23	

Primary Settlement Results

Surcharge =	435	lb/ft^2
Total Settlement =	12.49	in

Overburden

	87	pcf
	0	ft
	0	psf
	0	psf

Relocated Residuals

lk Density	87	pcf
Thickness	5	ft
Cover	0	psf
ed Stress	435	psf

Leachate Generation

Total change in void height	1.067	in
Landfill Area	0.39	acre
Total Leachate Volume	11,295	gal

Time Rate of Consolidation

Initial Drainage Length *10 ft*
c(v) 0.02 ft^2/day

Avg. Degree of Consolidatio	Tv	Time (years)	Volume (gal)	Flowrate (gal/year)
1%	0.00008	0.001	113	103,069
10%	0.00785	0.108	1,130	10,504
20%	0.0314	0.430	2,259	5,252
30%	0.0707	0.968	3,389	3,499
40%	0.126	1.726	4,518	2,618
50%	0.197	2.699	5,648	2,093
60%	0.286	3.918	6,777	1,730
70%	0.403	5.521	7,907	1,432
80%	0.567	7.767	9,036	1,163
90%	0.848	11.616	10,166	875
99%	1.781	24.397	11,182	458

Lift	Drainage Length (ft)	Time (weeks)	Time (years)	Tv	Avg. Degree :onsolidatic	Volume (gal)	Flowrate (gal/year)
	10		0.001	0.000073	0.96%	109	108,896
Cover	10	2	0.038356	0.0028	5.97%	674	17,583
	10		0.385	0.028105	18.92%	2,137	5,550
	10		*0.885*	*0.064605*	*28.68%*	*3,240*	*3,661*
	10		10	0.73	86.62%	9,784	978
	10		40	2.92	99.94%	11,288	282
	10		1.038	0.075774	31.06%	3,508	3,380

Secondary Consolidation Results

C(alpha)	0.018
Layer Thickness (ft)	15
Secondary Settlement (in)	3.24

Depth to Soil Layer Top (ft)	Bottom (ft)	Cc/(1+e)	Cr/(1+e)	sigma m' (lb/ft^2)	gamma (lb/ft^3)	zf (ft)	sigma c' (lb/ft^2)	sigma zo' (lb/ft^2)	delta sigma (lb/ft^2)	sigma zf' (lb/ft^2)	strain (%)	Settlement (in)	Change in Void Height (in)
0.0	0.0				87								
0.0	0.5	0.237		0	87	0.25	22	22	435	457	31.337	1.880	0.161
0.5	1.0	0.237		0	87	0.75	65	65	435	500	20.965	1.258	0.107
1.0	1.5	0.237		0	87	1.25	109	109	435	544	16.566	0.994	0.085
1.5	2.0	0.237		0	87	1.75	152	152	435	587	13.894	0.834	0.071
2.0	2.5	0.237		0	87	2.25	196	196	435	631	12.043	0.723	0.062
2.5	3.0	0.237		0	87	2.75	239	239	435	674	10.664	0.640	0.055
3.0	3.5	0.237		0	87	3.25	283	283	435	718	9.588	0.575	0.049
3.5	4.0	0.237		0	87	3.75	326	326	435	761	8.720	0.523	0.045
4.0	4.5	0.237		0	87	4.25	370	370	435	805	8.004	0.480	0.041
4.5	5.0	0.237		0	87	4.75	413	413	435	848	7.400	0.444	0.038
5.0	5.5	0.237		0	87	5.25	457	457	435	892	6.884	0.413	0.035
5.5	6.0	0.237		0	87	5.75	500	500	435	935	6.438	0.386	0.033
6.0	6.5	0.237		0	87	6.25	544	544	435	978	6.047	0.363	0.031
6.5	7.0	0.237		0	87	6.75	587	587	435	1022	5.702	0.342	0.029
7.0	7.5	0.237		0	87	7.25	631	631	435	1065	5.395	0.324	0.028
7.5	8.0	0.237		0	87	7.75	674	674	434	1109	5.119	0.307	0.026
8.0	8.5	0.237		0	87	8.25	718	718	434	1152	4.871	0.292	0.025
8.5	9.0	0.237		0	87	8.75	761	761	434	1195	4.645	0.279	0.024
9.0	9.5	0.237		0	87	9.25	805	805	434	1239	4.440	0.266	0.023
9.5	10.0	0.237		0	87	9.75	848	848	434	1282	4.252	0.255	0.022
10.0	10.5	0.237		0	87	10.25	892	892	434	1326	4.080	0.245	0.021
10.5	11.0	0.237		0	87	10.75	935	935	434	1369	3.920	0.235	0.020
11.0	11.5	0.237		0	87	11.25	979	979	433	1412	3.773	0.226	0.019
11.5	12.0	0.237		0	87	11.75	1022	1022	433	1455	3.636	0.218	0.019
12.0	12.5	0.237		0	87	12.25	1066	1066	433	1499	3.509	0.211	0.018
12.5	13.0	0.237		0	87	12.75	1109	1109	433	1542	3.390	0.203	0.017
13.0	13.5	0.237		0	87	13.25	1153	1153	432	1585	3.278	0.197	0.017
13.5	14.0	0.237		0	87	13.75	1196	1196	432	1628	3.174	0.190	0.016
14.0	14.5	0.237		0	87	14.25	1240	1240	432	1672	3.076	0.185	0.016
14.5	15.0	0.237		0	87	14.75	1283	1283	431	1715	2.983	0.179	0.015
15.0	15.5			-1305		15.25		1305	431	1736	#NUM!	#NUM!	#NUM!
15.5	16.0			-1305		15.75		1305	431	1736	#NUM!	#NUM!	#NUM!
16.0	16.5			-1305		16.25		1305	430	1735	#NUM!	#NUM!	#NUM!
16.5	17.0			-1305		16.75		1305	430	1735	#NUM!	#NUM!	#NUM!
17.0	17.5			-1305		17.25		1305	429	1734	#NUM!	#NUM!	#NUM!
17.5	18.0			-1305		17.75		1305	429	1734	#NUM!	#NUM!	#NUM!
18.0	18.5			-1305		18.25		1305	428	1733	#NUM!	#NUM!	#NUM!
18.5	19.0			-1305		18.75		1305	428	1733	#NUM!	#NUM!	#NUM!
19.0	19.5			-1305		19.25		1305	427	1732	#NUM!	#NUM!	#NUM!
19.5	20.0			-1305		19.75		1305	427	1732	#NUM!	#NUM!	#NUM!
20.0	20.5			-1305		20.25		1305	426	1731	#NUM!	#NUM!	#NUM!
20.5	21.0			-1305		20.75		1305	426	1731	#NUM!	#NUM!	#NUM!
21.0	21.5			-1305		21.25		1305	425	1730	#NUM!	#NUM!	#NUM!
21.5	22.0			-1305		21.75		1305	424	1729	#NUM!	#NUM!	#NUM!
22.0	22.5			-1305		22.25		1305	424	1729	#NUM!	#NUM!	#NUM!
22.5	23.0			-1305		22.75		1305	423	1728	#NUM!	#NUM!	#NUM!
23.0	23.5			-1305		23.25		1305	422	1727	#NUM!	#NUM!	#NUM!
23.5	24.0			-1305		23.75		1305	421	1726	#NUM!	#NUM!	#NUM!
24.0	24.5			-1305		24.25		1305	421	1726	#NUM!	#NUM!	#NUM!
24.5	25.0			-1305		24.75		1305	420	1725	#NUM!	#NUM!	#NUM!
25.0	25.5			-1305		25.25		1305	419	1724	#NUM!	#NUM!	

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SETTLEMENT ANALYSIS OF SHALLOW FOUNDATIONS

Classical Method

Date: August 6, 2008

Identification: 12th St Landfill - Relocated Residuals, Cover (3' thick)

Existing Residuals

Void Ratio	2	
Sat Density	87	pcf
w	0.83	
Gs	2.23	

Leachate Generation

Total change in void height	1.003	in
Landfill Area	1.84	acre
Total Leachate Volume	50,101	gal

Input

	Units	E E or SI
Shape	sq	SQ, CI, CO, or RE
B =	285	ft
L =	285	ft
D =	0	ft
P =		k
Dw =	100	ft
r =	1	

Primary Settlement Results

Surcharge =	393	lb/ft^2
Total Settlement =	11.74	in

Overburden

	87	Cover Soil Density
	0	Thickness
	0	
	0	Added Stress

Relocated Residuals

131	pcf
3	ft
0	psf
393	psf

Time (years)	Tv	Avg. Degree Consolidatic	Volume (gal)	Flowrate (gal/year)
0.001	0.000073	0.96%	483	483,022
0.3466	0.025302	17.95%	8,993	25,945
0.8466	0.061802	28.05%	14,054	16,601
10	0.73	86.62%	43,398	4,340
40	2.92	99.94%	50,071	1,252
0.9996	0.072971	30.48%	15,271	15,278

Time Rate of Consolidation

Drainage Length	10	ft
c(v)	0.02	ft^2/day

Avg. Degree of Consolidatio	Tv	Time (years)	Volume (gal)	Flowrate (gal/year)
1%	0.00008	0.001	501	457,176
10%	0.00785	0.108	5,010	46,591
20%	0.0314	0.430	10,020	23,296
30%	0.0707	0.968	15,030	15,519
40%	0.126	1.726	20,041	11,611
50%	0.197	2.699	25,051	9,283
60%	0.286	3.918	30,061	7,673
70%	0.403	5.521	35,071	6,353
80%	0.567	7.767	40,081	5,160
90%	0.848	11.616	45,091	3,882
99%	1.781	24.397	49,600	2,033

Secondary Consolidation Results

C(alpha)	0.018
Layer Thickness (ft)	20
Secondary Settlement (in)	4.32

Depth to Soil Layer Top (ft)	Bottom (ft)	Cc/(1+e)	Cr/(1+e)	sigma m' (lb/ft^2)	gamma (lb/ft^3)	zf (ft)	sigma c' (lb/ft^2)	sigma zo' (lb/ft^2)	delta sigma (lb/ft^2)	sigma zf' (lb/ft^2)	strain (%)	Settlement (in)	Change in Void Height (in)
0.0	0.0				87								
0.0	0.5	0.237		0	87	0.25	22	22	393	415	30.344	1.821	0.156
0.5	1.0	0.237		0	87	0.75	65	65	393	458	20.063	1.204	0.103
1.0	1.5	0.237		0	87	1.25	109	109	393	502	15.738	0.944	0.081
1.5	2.0	0.237		0	87	1.75	152	152	393	545	13.131	0.788	0.067
2.0	2.5	0.237		0	87	2.25	196	196	393	589	11.334	0.680	0.058
2.5	3.0	0.237		0	87	2.75	239	239	393	632	10.002	0.600	0.051
3.0	3.5	0.237		0	87	3.25	283	283	393	676	8.968	0.538	0.046
3.5	4.0	0.237		0	87	3.75	326	326	393	719	8.137	0.488	0.042
4.0	4.5	0.237		0	87	4.25	370	370	393	763	7.453	0.447	0.038
4.5	5.0	0.237		0	87	4.75	413	413	393	806	6.879	0.413	0.035
5.0	5.5	0.237		0	87	5.25	457	457	393	850	6.390	0.383	0.033
5.5	6.0	0.237		0	87	5.75	500	500	393	893	5.967	0.358	0.031
6.0	6.5	0.237		0	87	6.25	544	544	393	937	5.598	0.336	0.029
6.5	7.0	0.237		0	87	6.75	587	587	393	980	5.273	0.316	0.027
7.0	7.5	0.237		0	87	7.25	631	631	393	1024	4.985	0.299	0.026
7.5	8.0	0.237		0	87	7.75	674	674	393	1067	4.726	0.284	0.024
8.0	8.5	0.237		0	87	8.25	718	718	393	1111	4.494	0.270	0.023
8.5	9.0	0.237		0	87	8.75	761	761	393	1154	4.284	0.257	0.022
9.0	9.5	0.237		0	87	9.25	805	805	393	1198	4.092	0.246	0.021
9.5	10.0	0.237		0	87	9.75	848	848	393	1241	3.918	0.235	0.020
10.0	10.5	0.237		0	87	10.25	892	892	393	1285	3.757	0.225	0.019
10.5	11.0	0.237		0	87	10.75	935	935	393	1328	3.610	0.217	0.018
11.0	11.5	0.237		0	87	11.25	979	979	393	1372	3.473	0.208	0.018
11.5	12.0	0.237		0	87	11.75	1022	1022	393	1415	3.347	0.201	0.017
12.0	12.5	0.237		0	87	12.25	1066	1066	393	1459	3.230	0.194	0.017
12.5	13.0	0.237		0	87	12.75	1109	1109	393	1502	3.120	0.187	0.016
13.0	13.5	0.237		0	87	13.25	1153	1153	393	1546	3.018	0.181	0.015
13.5	14.0	0.237		0	87	13.75	1196	1196	393	1589	2.922	0.175	0.015
14.0	14.5	0.237		0	87	14.25	1240	1240	393	1632	2.832	0.170	0.015
14.5	15.0	0.237		0	87	14.75	1283	1283	393	1676	2.748	0.165	0.014
15.0	15.5	0.237		0	87	15.25	1327	1327	393	1719	2.668	0.160	0.014
15.5	16.0	0.237		0	87	15.75	1370	1370	393	1763	2.593	0.156	0.013
16.0	16.5	0.237		0	87	16.25	1414	1414	393	1806	2.522	0.151	0.013
16.5	17.0	0.237		0	87	16.75	1457	1457	393	1850	2.455	0.147	0.013
17.0	17.5	0.237		0	87	17.25	1501	1501	392	1893	2.391	0.143	0.012
17.5	18.0	0.237		0	87	17.75	1544	1544	392	1937	2.331	0.140	0.012
18.0	18.5	0.237		0	87	18.25	1588	1588	392	1980	2.273	0.136	0.012
18.5	19.0	0.237		0	87	18.75	1631	1631	392	2024	2.218	0.133	0.011
19.0	19.5	0.237		0	87	19.25	1675	1675	392	2067	2.166	0.130	0.011
19.5	20.0	0.237		0	87	19.75	1718	1718	392	2110	2.116	0.127	0.011
20.0	20.5			-1740		20.25		1740	392	2132	#NUM!	#NUM!	#NUM!
20.5	21.0			-1740		20.75		1740	392	2132	#NUM!	#NUM!	#NUM!
21.0	21.5			-1740		21.25		1740	392	2132	#NUM!	#NUM!	#NUM!
21.5	22.0			-1740		21.75		1740	392	2132	#NUM!	#NUM!	#NUM!
22.0	22.5			-1740		22.25		1740	392	2132	#NUM!	#NUM!	#NUM!
22.5	23.0			-1740		22.75		1740	392	2132	#NUM!	#NUM!	#NUM!
23.0	23.5			-1740		23.25		1740	392	2132	#NUM!	#NUM!	#NUM!
23.5	24.0			-1740		23.75		1740	392	2132	#NUM!	#NUM!	#NUM!
24.0	24.5			-1740		24.25		1740	392	2132	#NUM!	#NUM!	#NUM!
24.5	25.0			-1740		24.75		1740	392	2132	#NUM!	#NUM!	#NUM!
25.0	25.5			-1740		25.25		1740	391	2131	#NUM!	#NUM!	

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12th Street Landfill - Otsego Township, Michigan
Leachate Discharge and Settlement Analysis

Lift	Residual Thickness (ft)	Area (sf)	Area (ac)	Avg Area (ft)	Avg. Area (ac)	Avg. Sqrt (ft)
0	0	155327.1	3.56582	155327.1	3.57	394
1	0	155327.1	3.56582			
	5	100142.1	2.298946	127734.6	2.93	357
2	5	100142.1	2.298946			
	10	55727.5	1.279327	77934.8	1.79	279
3	10	55727.5	1.279327			
	15	28789.1	0.660907	42258.3	0.97	206
4	15	28789.1	0.660907			
	20	5313.8	0.121988	17051.45	0.39	131
Cover (3' thick)	0	155327.1	3.56582			
	20	5313.8	0.121988	80320.45	1.84	283

By: S. Jorgensen Date: 5/14/08
Checked: H. Hinke Date: 5/21/08

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12th Street Landfill

Fill thickness contour (relocated paper residual)

SCALE 1"= 100'

Logical Names

REF1LN
REF2LN
REF3LN
REF4LN
REF5LN
REF6LN
REF7LN
REF8LN
REF9LN
REF10LN

Levels

REF1LV
REF2LV
REF3LV
REF4LV
REF5LV
REF6LV
REF7LV
REF8LV
REF9LV
REF10LV

Reference Files

$$REF01$$
$$REF02$$
$$REF03$$
$$REF04$$
$$REF05$$
$$REF06$$
$$REF07$$
$$REF08$$
$$REF09$$
$$REF10$$

Plot Data

DGN
USER
PRF
No Pen Table
PLOTTER
$$SCALE$$
$$ROT$$
DATE -
LEVELS
.